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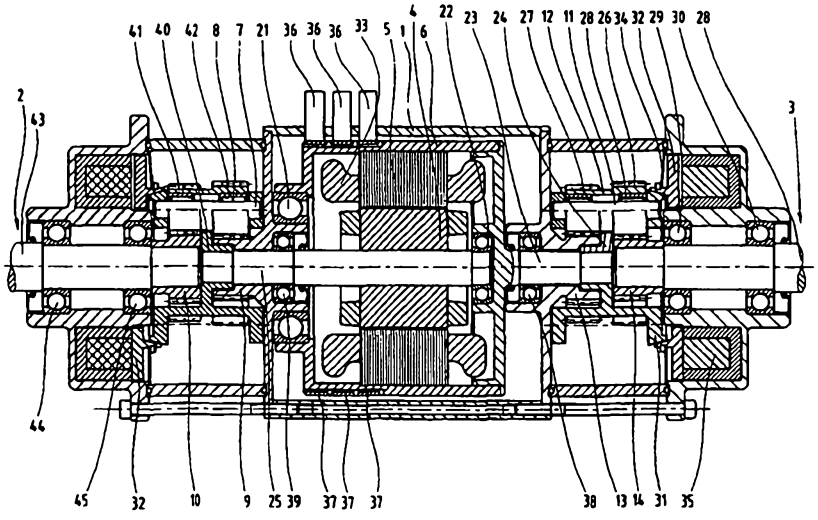
(54) Title: DRIVE MECHANISM FOR A VEHICLE, ESPECIALLY A MULTILANE ELECTROMOBILE

(54) Bezeichnung: ANTRIEB FÜR EIN FAHRZEUG, INSBESONDERE FÜR EIN MEHRSPURIGES ELEKTROMOBIL

(57) Abstract

The invention relates to an electric drive mechanism for a vehicle, more particularly a multilane electromobile. A housing (1), which is stationary in relation to the vehicle body or the frame of the vehicle, is provided. A motor housing (6) with a stator (5) and a rotor (4) fitted in the motor housing (6) are rotationally mounted in said housing (1). The motor housing (6) and the rotor (4) carry out a turning motion in the opposite direction during operation. A drive train (2) is connected to the rotor (4) or the motor housing (6). The turning motion of the rotor (4) or the motor housing (6) is transmitted by a transmission device with an input or output turning motion in the same direction. Another drive train (3) is connected to the motor housing (6) or the rotor (4). The turning motion of the motor housing (6) or the rotor (4) is transmitted by a transmission device with input and output turning motion in the opposite direction.



Abstract

The invention relates to an electric drive for a motor vehicle, in particular for a multi-track electromobile. For this a housing (1) fixed relative to the vehicle structure or the vehicle frame is provided, wherein in said housing (1) a. motor frame (6) with a stator (5) and a rotor (4) provided in the motor frame (6) arc mounted rotatably respectively. The motor frame (6) and the rotor (4) rotate in opposite directions for work output, whereby one drive line (2) is connected with the rotor (4) or with the motor frame (6), and the rotational movement of the rotor (4) or the motor frame (6) is connected by a transmission device with a drive and output rotating in the same direction and a second drive line (3) is connected with the motor frame (6) or the rotor (4), and the rotational movement of the motor frame (6) or the rotor (4) is transmitted by a transmission device with a drive and output rotating in opposite directions.

For Abstract use Fig. 3.

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Baden, 4.7.2000

Mag. Ingrid Neff
Certified court interpreter

Mag. phil. Ingrid Neff
Allgem. beeideter und gerichtlich zertifizierter Dolmetsch für Englisch
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AUSTRALIAN PATENT OFFICE

The invention relates to an electric drive for a motor vehicle, in particular for a multi-track electromobile.

Such types of electric drives are being used more and more in twin-track motor vehicles, in both road and commercial vehicles. The usual design uses mainly two independent electric motors, which are geared down by a spur gear or planet gear so that the motors can run at a much higher speed than the drive gears. In this way the structural volume and the weight of the driving unit can be reduced. A considerable disadvantage however is the great expense of the individual parts.

Thus DE 25 06 807 B describes an electric motor with two side output, in the stators of which two mechanically and electrically independent rotors are excited jointly by the stator, whereby the rotors are positioned so that no end shield is necessary for the rotor bearing opposite the respective output side.

In DE 42 36 093 A, a drive system for an electric vehicle is described, which comprises several motors and reducing gears with planet gear devices, which are connected in a force transmitting way between the motors and the gears of the electric vehicle, whereby the improvement is that the motors and gears are arranged coaxially, so that they can be arranged coaxially between the right and left wheel of the electric vehicle. Here all of the described driving components are arranged in a housing. By means of a suitable choice of force transmission by means of the gear devices the torque distribution to the wheel axes can be influenced advantageously.

Likewise DE 44 21 425 C describes the drive of a road vehicle with an electrical drive unit in which two separately functioning units each with an electric motor and a gear arranged facing the respective drive gear, designed as a spur gear with an output shaft arranged eccentric to the axis of rotation of the electric motor or as a planet gear, act on the drive wheels of a vehicle axis, Electric motors, gears and output shaft bearing are thus mounted on a common support member,

The disadvantage of the above described conventional drive units is the use of two mechanically and electrically independent electric motors, whereby for each drive wheel more or less the same expense is required, as a gear is also assigned to each drive wheel.

The object of the invention is to create an electric drive for a motor vehicle which on the one hand avoids the disadvantages of the aforementioned drives and on the other hand is easy to assemble and meets the requirement of independent rotational speeds for the left and right drive gear of an axis.

Accordingly, the present invention provides an electric drive for a motor vehicle, whereby a housing fixed relative to the motor vehicle structure or the vehicle frame is provided, and in said housing a motor frame with a stator and a rotor provided in the motor frame are rotatably mounted respectively and the motor frame and the rotor rotate in opposite directions for work output, whereby one drive line is connected with the rotor or with the motor frame and the rotational movement of the rotor or the motor frame is connection by a transmission device with the drive and output rotating in the same direction and a second drive line is connected with the motor frame or with the rotor and the rotational movement of the motor frame or the rotor is transmitted by a transmission device with a drive and output rotating in an opposite direction, wherein the transmission devices are planet gears, whereby the rotor is securely connected via the shaft or the motor frame with a planet cage of the assigned planet gear, and moves a planet axis of at least one planet gear set.

With the invention it is possible for the first time to create a drive, which is arranged between the left and the right drive wheel, which fulfils the differential function and takes up so little space that a rigid, coaxial connection between the gear axes and the drive is possible without reducing the ground clearance of the vehicle to an impermissible extent. The invention is based on the fact that in every drive engine, which provides its mechanical power by means of a rotational movement, the torque on the output shaft is equal to the torque at which the engine has to be supported relative to its environment. In the conventional design with a fixed engine thus the driving power is provided exclusively by the moving output shaft. The invention however aims to achieve a branching out of output to two drive lines in order to accommodate the conditions of the vehicle drive. This can be arranged according to the invention in that on the one hand that output shaft performs a rotational movement, for example the rotor, via the first drive line, on the other hand the motor frame also performs a rotational movement in an opposite direction to the rotational direction of the output

shaft via the second drive line. A work of both drive lines is achieved if the rotational movement is in the same direction as the occurring torque, which is necessarily the case in the arrangement according to the invention. By means of electromagnetic generation of torque, which one the one hand is picked up as an action torque on the output shaft and on the other hand exists as a reaction torque on the motor frame, there is no mechanical connection between these two parts of the arrangement, which prevents the free rotatability of both parts. In a drive for a road vehicle it is thus necessary that the work output of the drive gears is performed with the same directional rotational movement of the right and left gear. This is achieved by the drive according to the invention.

Preferably, rotational movement of the rotor via the shaft or the rotational movement of the motor frame moves the planet axis at least of a planet gear set, which comprises at least two rotation-fast connected gears, the axes of rotation of which rotate rigidly coupled about the axis of rotation of the shaft or the motor frame, and in that one gear of the planet gear set meshes with a sun gear arranged rotation-fast with the housing concentric to the shaft or motor frame axis, and an additional gear of the planet gear set meshes with a sun gear arranged concentrically to the shaft or motor housing axis, which sun gear drives the assigned gear shaft, whereby the sun gear assigned to the housing has a different diameter to the sun gear assigned to the gear shaft.

Preferably, in one drive line the sun gear assigned to the housing has a smaller diameter than the sun gear assigned to the gear shaft and in the other drive line the sun gear assigned to the housing has a greater diameter than the sun gear assigned to the gear shaft.

Preferably, the transmission devices have a transmission ratio which corresponds to the ratio of the diameters of the fixed sun gears.

Preferably, the transmission device is designed in two stages, whereby a planet axis rotates with the shaft or with the motor frame, on which a planet gear set with three relatively fixed gears is rotatably mounted, and the planet gear set on the one hand is in engagement with freely rotatable sun gears, which are alternatively securable be means of a braking device, and on the other hand with the sun gear assigned to the gear shaft.

Preferably, the planet cage is provided on the output side with a surface in particular with a conical frictional surface, against which a brake disc mounted rotation-fast relative to the housing acts by means of an electromagnetic activating device.

Preferably, a mechanical brake is provided, which simultaneously brakes the rotational movement of the motor frame and the rotational movement of the rotor.

Preferably, the mechanical brake acts on the outer periphery of the motor frame or on the outer periphery of the planet cage connected with the shaft.

Preferably, the mechanical brake is a divided or slotted ring.

Preferably, the mechanical brake is activatable by a cable pull.

Preferably, the mechanical brake is activated magnetically by means of a lifting magnet on the cable pull.

The invention is explained in more detail in the following by way of the embodiments illustrated in the drawings, in which:

Fig. 1 is a schematic view of the drive;

Fig. 2 is a two stage design of the transmission device;

Fig. 3 is an electric drive in cross section; and

Fig. 4 is a further variant of a drive in cross section.

First of all it is noted that in the various described embodiments the same parts are allocated the same reference numbers or the same component names, whereby the disclosures contained throughout the description can be applied by analogy to the same parts with the same reference numbers or same component names. Also position details given in the description, such as e.g. top, bottom, side etc. relate to the Figure being described at the

time and with a change of position should be transferred accordingly to the new position. Furthermore, individual features or combinations of features from the shown and described different embodiments can represent independent, inventive solutions or solutions according to the invention.

According to Fig. 1 the electric drive comprises a housing 1 that is fixed relative to the motor vehicle, from which on both sides a first drive line 2 and a second drive line 3 are guided. The torque of the first drive line 2 is provided by a shaft 25 of a freely rotatably mounted rotor 4, the torque of the second drive line 3 is provided by a stator 5, which is secured in a motor frame 6. The motor frame 6 is securely connected to a shaft end 23 of the second drive line 3. The rotational torque of the first drive line 2 moves a planet axis 7 of a planet gear set 8, which on the one hand engages with a sun gear 9 of the transmission device of the first drive line 2 fixed relative to the motor vehicle, and on the other hand with a sun gear 10 of the first drive line 2 rotatable with a gear shaft 43. In the transmission device of the first drive line 2 the fixed sun gear 9 is smaller than the rotatable sun gear 10, whereby the drive and output shaft of the transmission device are rotated in the same direction. Furthermore, the rotational movement of the second drive line 3 moves a planet axis 11 of a planet gear set 12, which on the one hand engages with a sun gear 13 of the transmission device of the second drive line 3 fixed relative to the motor vehicle and on the other hand with a sun gear 14 of the second drive line 3 rotatable with a gear shaft 28. In the transmission device of the second drive line 3 the fixed sun gear 13 is larger than the

rotatable sun gear 14, whereby an opposite rotational movement of the drive and output shaft of the transmission device is effected.

Fig. 2 shows a schematic view of a two stage transmission device of a drive line 3, whereby the transmission device of the second drive line 2 has to be modified accordingly, in that a planet axis 15 rotates with the shaft end 23 on which a planet gear set 16 with three gears is rotatably mounted. The planet gear set 16 is on the one hand in engagement with freely rotatable sun gears 17, 18, which can be secured optionally or alternatively relative to the motor vehicle by a braking device 19, and on the other hand is in engagement with a Sun gear 20, which is connected with the gear shaft 28.

According to Fig. 3 the electric drive comprises the fixed housing 1, in which by means of roller bearings 21, 22 the freely rotatable motor frame 6, in which the stator 5 of the electric motor is secured, is mounted, The shaft end 23 firmly connected with the motor frame 6 is securely connected with a planet cage 24 of the transmission device, on the planet axis 11 of which the planet gear set 12 is mounted freely rotatably on roller bearings 26, 27. The planet gear set 12 engages on the one hand in the sun gear 13 fixed relative to the housing 1 and on the other hand in the sun gear 14 which is secured onto the right gear shaft 28. The gear shaft 28 is mounted on two roller bearings 29, 30 rotatably relative to the housing 1. The planet cage 24 is designed on the output side with a conical frictional surface 317 on which a brake disc 32 mounted rotation-fast relative to the housing 1 can rest. The brake disc 32 is in a position of rest forced by a disc spring 34 axially against the conical

frictional surface 31 of the planet cage 24. By means of an electromagnetic activation device 35 the axial force of the disc spring 34 can be overcome and thereby the brake can be lifted.

The supply of electric power to an excitation winding 33 of the stator 5 is performed via carbon 36 on slip rings 37 on the rotatable motor frame 6. The left drive line 2 is formed by the rotor 4 of the electric motor, which is rotatably mounted on the right side in the motor frame 6 by a roller bearing 38 and on the left side in the housing 1 also by a roller bearing 39, and is securely connected with a planet cage 40 of the left transmission device, on the planet axis 7 of which the planet gear set 8 is mounted freely rotatably on roller bearings 41, 42. The planet gear set 8 engages on the one hand in the sun gear 9 fixed relative to the housing 1, and on the other hand in the sun gear 10, which is secured on the right gear shaft 43. The gear shaft 43 is mounted on two roller bearings 44, 45 rotatably relative to the housing 1. The braking device with the brake disc 32 of the left drive line 2 is designed corresponding to the right drive line 3. The fixed sun gear 9 of the left drive line 2 is the same size as the rotatable sun gear 14 of the right drive line 3. The same applies to the sun gear 13 and sun gear 10.

As the rotational diameter of the planet axes 7 and Ii is of equal size, the transmission ratios for the left and right transmission device are produced.

According to Fig. 4 the electric drive comprises the fixed housing 1, in which by means of a roller bearing 46 the motor frame 6, which is securely connected to the planet cage 47, is

mounted on one side. In the motor frame 6 the stator 5 and the rotor 4 with its shaft 25 are also provided. The rotor 4 is in turn securely connected with a planet cage 48, which is mounted by a roller bearing 49 in the housing 1. The second bearing of the rotor 4 is performed by a roller bearing 50 which is arranged in the motor frame 6 The second bearing of the motor frame 6 is made by a roller bearing 51 which is positioned on the shaft 25.

The gear shaft 43 is on the one hand mounted by the roller bearing 44 arranged in the housing 1 and on the other hand by a roller bearing 52 provided in the planet cage 48. The gear shaft 28 is mounted by the roller bearing 30 arranged in the housing I and a roller bearing 53 provided in the motor frame 6.

The planet gear for the gear shaft 43 with its planet cage 48 comprises a planet gear set 54 and a fixed sun gear 55 securely connected to the housing 1 and a sun gear 56 securely connected to the gear shaft 42. The planet gear for the gear shaft 28 with its planet cage 47 comprises technically analogously a planet gear set 57 and a fixed sun gear 58 securely connected with the housing 1 and a sun gear 59 securely connected with the gear shaft 28. The rotational movement of the rotor 4 or the motor frame 6 is transmitted by the planet gear, as in the embodiment according to Fig. 3, to the gear shafts28and43.

As a braking device 19 a mechanical brake 60 is provided which acts on the outer periphery of the motor frame 6 or on the outer periphery of the planet cage 48 connected with the shaft 25. Said mechanical brake 60 is a divided ring which is activated by a. cable pull 61.

Finally, for form's sake it is noted that for a better understating of the structure of the drive, the latter and its components are illustrated partly untrue to scale and/or are enlarged and/or made smaller.

The problem forming the basis of the separate solutions according to the invention can be taken from the description.

Above all the individual embodiments shown in Figs. 1; 2; 3; 4 can form the subject matter of independent solutions according to the invention. The problems and solutions relating thereto according to the invention are to be taken from the detailed descriptions of these figures.

The claims defining the invention are as follows:

1. Electric drive for a motor vehicle, whereby a housing fixed relative to the motor vehicle structure or the vehicle frame is provided, and in said housing a motor frame with a stator and a rotor provided in the motor frame are rotatably mounted respectively and the motor frame and the rotor rotate in opposite directions for work output, whereby one drive line is connected with the rotor or with the motor frame and the rotational movement of the rotor or the motor frame is connection by a transmission device with the drive and output rotating in the same direction and a second drive line is connected with the motor frame or with the rotor and the rotational movement of the motor frame or the rotor is transmitted by a transmission device with a drive and output rotating in an opposite direction, wherein the transmission devices are planet gears, whereby the rotor is securely connected via the shaft or the motor frame with a planet cage of the assigned planet gear, and moves a planet axis of at least one planet gear set.

2. Electric drive according to claim 1, wherein rotational movement of the rotor via the shaft or the rotational movement of the motor frame moves the planet axis at least of a planet gear set, which comprises at least two rotation-fast connected gears, the axes of rotation of which rotate rigidly coupled about the axis of rotation of the shaft or the motor frame, and in that one gear of the planet gear set meshes with a sun gear arranged rotation-fast with the housing concentric to the shaft or motor frame axis, and an additional gear of the planet gear set meshes with a sun gear arranged concentrically to the shaft or motor housing axis, which sun gear drives the assigned gear shaft, whereby the sun gear assigned to the housing has a different diameter to the sun gear assigned to the gear shaft.

3. Electric drive according to claim 2, wherein in one drive line the sun gear assigned to the housing has a smaller diameter than the sun gear assigned to the gear shaft and in the other drive line the sun gear assigned to the housing has a greater diameter than the sun gear assigned to the gear shaft.

4. Electric drive according to claim 2, wherein the transmission devices have a transmission ratio which corresponds to the ratio of the diameters of the fixed sun gears.

5. Electric drive according to claim 1, wherein the transmission device is designed in two stages, whereby a planet axis rotates with the shaft or with the motor frame, on which a planet gear set with three relatively fixed gears is rotatably mounted, and the planet gear set on the one hand is in engagement with freely rotatable sun gears, which are alternatively securable be means of a braking device, and on the other hand with the sun gear assigned to the gear shaft.

6. Electric drive according to any one of claims 1 to 5, wherein the planet cage is provided on the output side with a conical frictional surface, against which a brake disc mounted rotation-fast relative to the housing acts by means of an electromagnetic activating device.

7. Electric drive according to any one of claims 1 to 6, wherein a mechanical brake is provided, which simultaneously brakes the rotational movement of the motor frame and the rotational movement of the rotor.

8. Electric drive according to claim 7, wherein the mechanical brake acts on the outer periphery of the motor frame or on the outer periphery of the planet cage connected with the shaft.

9. Electric drive according to claim 7 or 8, wherein the mechanical brake is a divided or slotted ring.

10. Electric drive according to any one of claims 7 to 9, wherein the mechanical brake is activatable by a cable pull.

11. Electric drive according to any one of claims 7 to 9, wherein the mechanical brake is activated magnetically by means of a lifting magnet on the cable pull.

12. Electric drive substantially as hereinbefore described with reference to any one of the embodiments shown in the accompanying drawings.

Dated 10 January 2002

Oskar Wachauer

Patent Attorneys of the Applicant/Nominated person

SPRUSON & FERGUSON

Fig.1

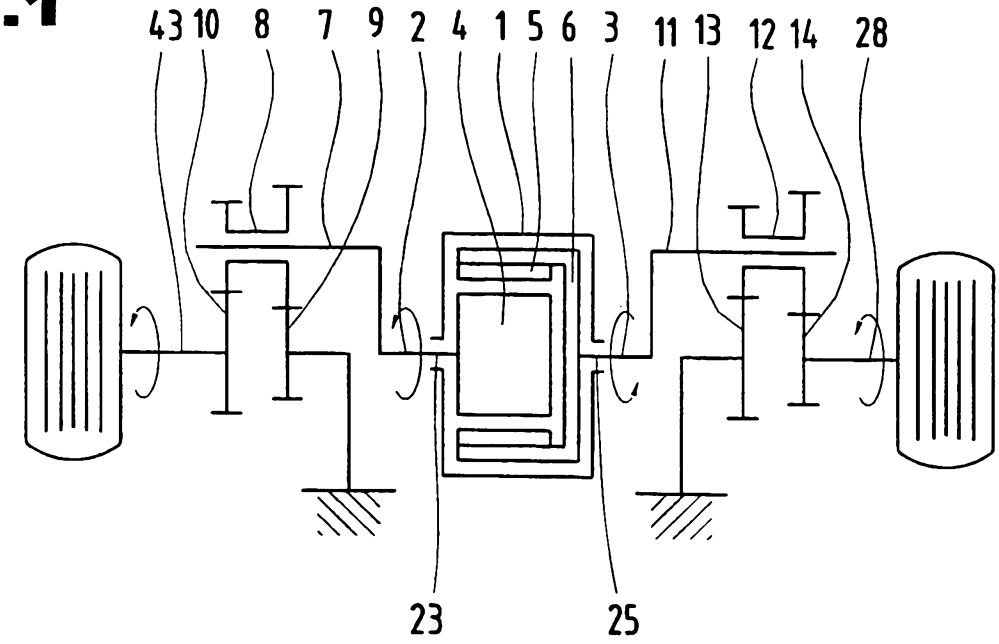
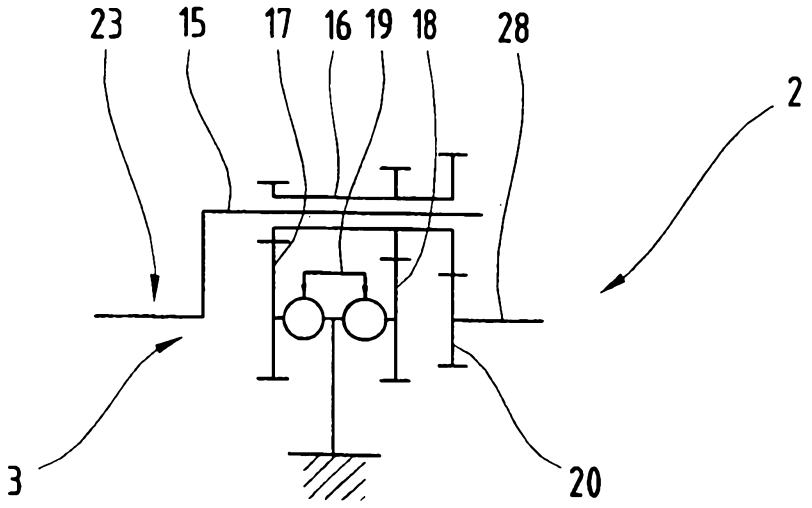


Fig.2



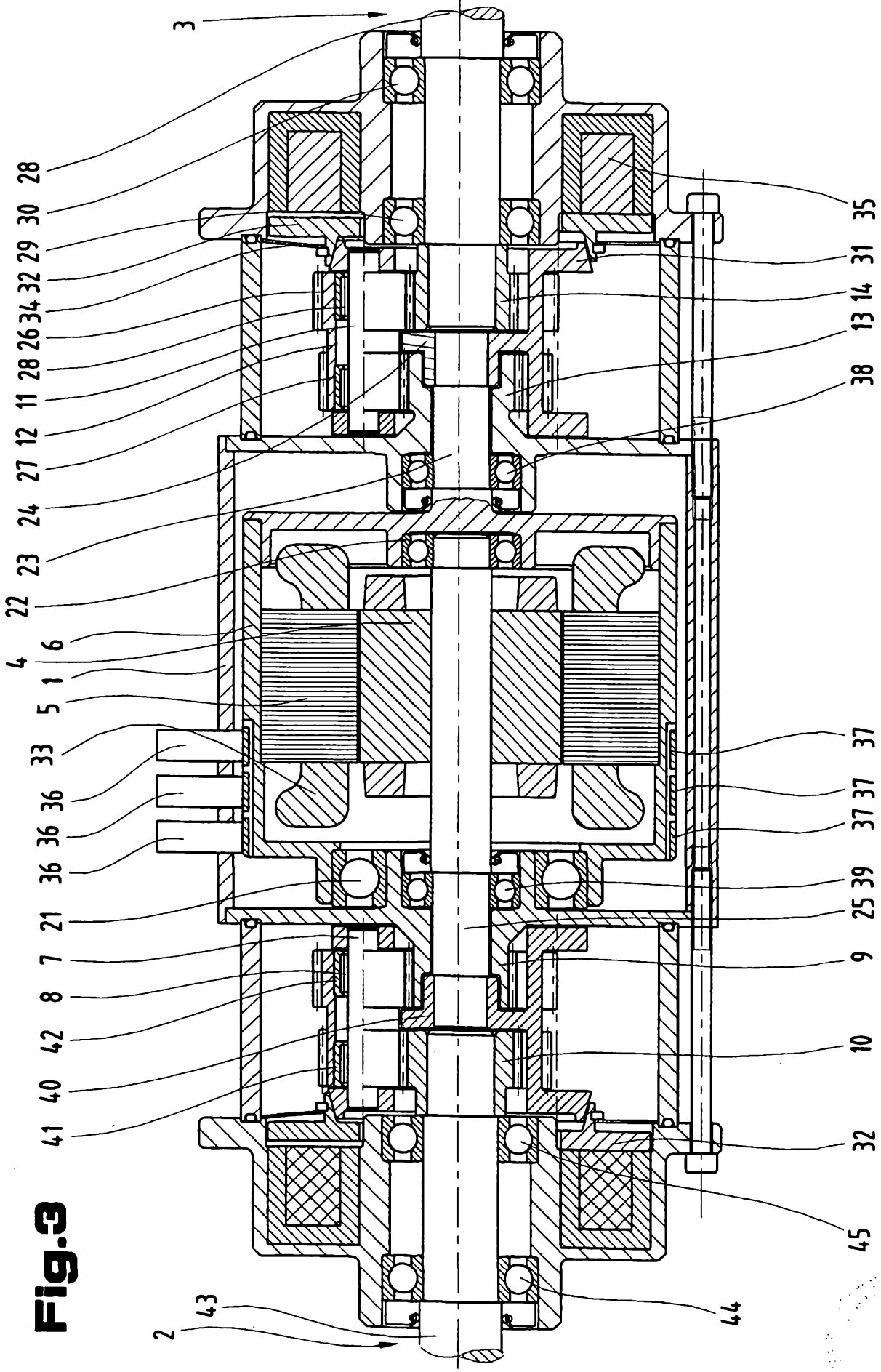

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Fig.3

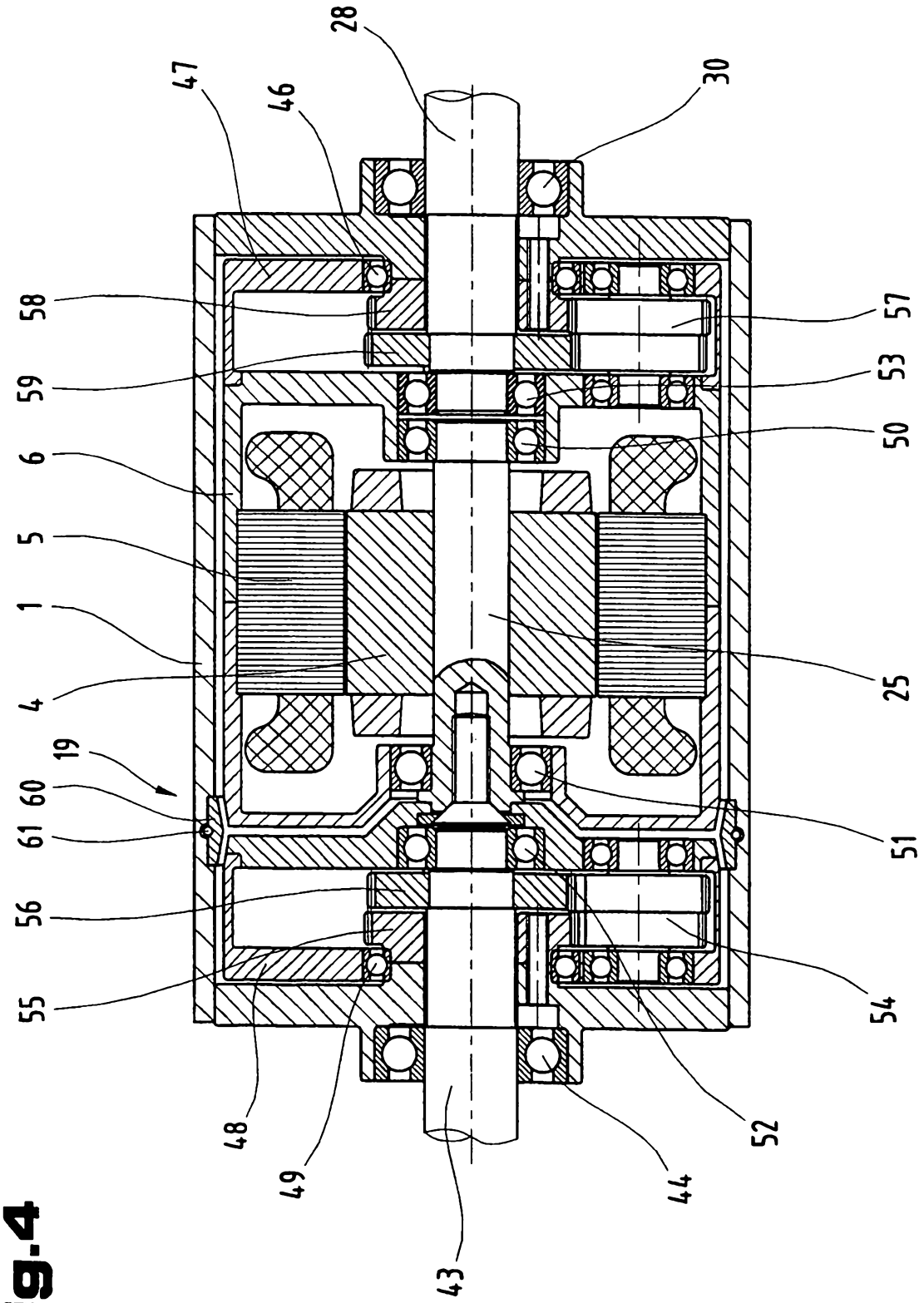

Fig.4