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(54) Drive member for a door or main door

(57) Drive member (10) for a door or main door (11), comprising at least a motor (13) that generates a motion having a determinate torque and a determinate speed, and a reducer (15) connected on one side to the output of the motor (13) and, on the other side, to the door (11), in order to vary in a desired manner the values of torque and speed of the motion generated by the motor (13), so as to determine the correct movement of the door (11). The motor (13) comprises an electric motor (16) having a drive shaft (17) to transmit the motion, and a first reduction kinematism (19) directly connected mechanically to the drive shaft (17) to determine a first variation in the ratios of torque and speed of the motion, in order to transmit them to an associated first transmission shaft (22). The reducer (15) comprises a second transmission shaft (23), or input shaft, mechanically connected and coaxial to the first transmission shaft (22); a second reduction kinematism (26) mechanically connected to the second transmission shaft (23), to determine a second variation in the ratios of torque and speed of the motion; a third reduction kinematism (30) kinematically connected to the second reduction kinematism (26), to determine a third variation in the ratios of torque and speed of the motion; a third transmission shaft (33) mechanically connected to the third reduction kinematism (30); a fourth reduction kinematism (35) mechanically connected to the third transmission shaft (33), or intermediate shaft, to determine a fourth variation in the ratios of torque and speed of the motion; and a fourth transmission shaft (39), or output shaft, mechanically connected to the fourth reduction kinematism (35), and to which the door (11) is mechanically connected. The output shaft (39) is located in an intermediate position between the input shaft (23) and the intermediate shaft (33).

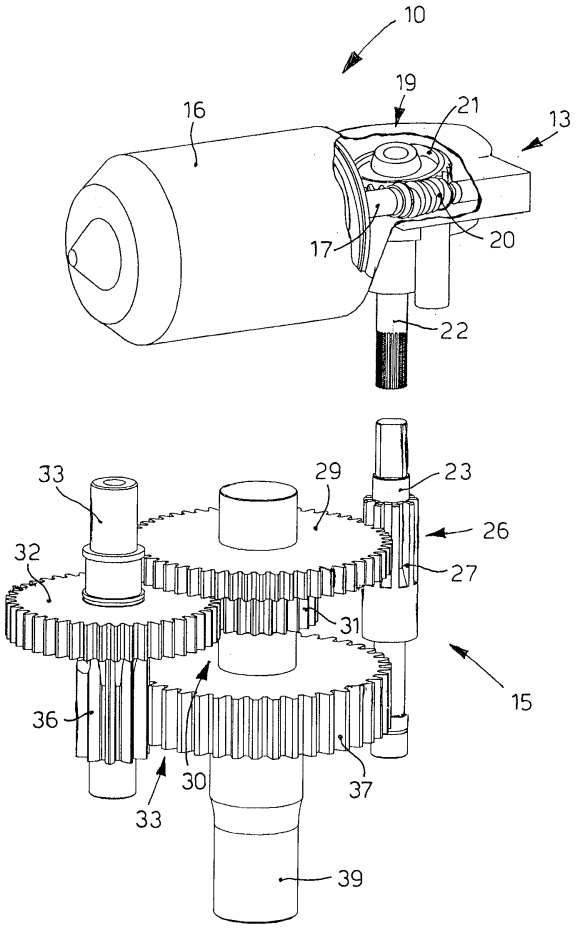

fig. 3

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a drive member which can be used to move a door, or a main door, so as to determine the automatic opening or closing of the door in order to allow selective access to a passage with which it is associated. In particular the present invention is applied, preferentially but not restrictively, for the movement of leaf-type doors or main doors, even though it is not to be excluded that the present invention can be equally applied to doors, or main doors which are of the pivoting, sliding, sectional or other type, which provide a movement to allow selective access to the passage.

BACKGROUND OF THE INVENTION

[0002] Doors, main doors or other similar closing elements are known, comprising one or more selectively movable leaves, to allow selective access through a passage with which the doors are associated.

[0003] It is also known to connect one or more drive members operatively to the leaves of the doors, in order to allow the automatic opening and closing thereof, also with remote control.

[0004] Different types of drive members are known, mainly of the electronic type, which provide a medium-power electric motor, that is, comprised between about 30W and about 60W, fed with direct current, or between about 150W and about 250W, fed with alternating current. Normally, the torque at exit from the known drive members is comprised between about 180Nm and about 220Nm.

[0005] The electric motor of known drive members is kinematically connected to a reducer, through which the values of speed and torque at exit are varied as desired, in order to activate the movement of the leaf.

[0006] The electric motors used, since they need the above indicative values of power, have relatively bulky dimensions.

[0007] However, in order to be housed on board the leaf which is to be moved, the drive members must have a relatively contained total bulk.

[0008] Therefore the electric motors normally used are disposed in particular combinations with the relative reducer, so as to limit as much as possible the space needed for their installation.

[0009] This entails an increase in the complexity both of the assembly and the maintenance of the whole drive member, with a consequent increase in times and costs of intervention.

[0010] Moreover, the reducers known today for the application in this type of known drive member actuate a minimum reduction in the values of torque and speed at exit from the motor, also to contain the overall dimensions of the drive member.

[0011] Furthermore, with known drive members, both the electric motor used and also the type of reducer applied must be designed and made each time according to the specific technical and operational needs, and must therefore provide different mechanical solutions for the reduction and positioning of the motor.

[0012] Normally drive members are used in which the relative reducer alternatively has two reduction ratios with worm screw-toothed wheel, or with four or three reduction ratios with toothed wheels, or with mixed couplings of screw-toothed wheel or other.

[0013] Reducers with epicycloidal mechanisms are also known, but they have extremely high production and management costs.

[0014] The prior art document US-A-3784117 shows a train of gears used to open a door or main door which uses four parallel shafts and in which the transmission of motion is always in a single direction from an entry side to an exit side.

[0015] GB-A-1057063 describes a train of gears for conical torque with an entry shaft orthogonal to the exit shaft and bevel gear pairs that determine the motion for a series of shafts disposed adjacent between the entry and exit of the gear train.

[0016] Purpose of the present invention is to achieve a drive member for a door or main door that is simple and economical to make, that allows to overcome the disadvantages of the state of the art and that develops a torque at exit that is greater than that of members known in the state of the art and having an overall reduced bulk.

[0017] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0018] The present invention is set forth and characterized in the independent claim, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0019] In accordance with said purpose, a drive member according to the present invention is advantageously applied for moving a door or main door.

[0020] In particular, the drive member according to the present invention comprises at least a drive mean having its own nominal power, and able to generate a motion having a determinate torque and a determinate speed, and a reducing mean able to be connected on one side to the exit of said drive mean and on the other side to the main door, so as to vary as desired the values of torque and speed of the motion generated by the drive mean, so as to determine the correct movement of the door.

[0021] According to a characteristic feature of the present invention, the drive mean comprises an electric motor having a drive shaft able to transmit said motion, and a first reduction kinematism that is directly connected mechanically to the drive shaft, and able to determine a first variation in the ratios of torque and speed of motion,

so as to transmit them to an associated first transmission shaft.

[0022] According to a characteristic of the present invention, the reducing mean comprises:

- a second transmission shaft, or input shaft, mechanically connected and coaxial with the first transmission shaft;
- a second reduction kinematism mechanically connected to the second transmission shaft, and able to determine a second variation in the ratios of torque and speed of motion;
- a third reduction kinematism kinematically connected to the second reduction kinematism, and able to determine a third variation in the ratios of torque and speed of motion;
- a third transmission shaft, or intermediate shaft, mechanically connected to the third reduction kinematism;
- a fourth reduction kinematism mechanically connected to the third transmission shaft, and able to determine a fourth variation in the ratios of torque and speed of motion; and
- a fourth transmission shaft, or output shaft, located in an intermediate position between the second and the third transmission shaft, mechanically connected to the fourth reduction kinematism and with which said main door is able to be mechanically connected.

[0023] With the present invention, all in all the entire drive member has at least a drive shaft, four transmission shafts and four kinematisms, to effect four variations in the ratios of torque and speed of the motion. However, there are three axes, since the second transmission shaft is coaxial with the drive shaft. Moreover, the intermediate position of the output shaft with respect to the input shaft and the intermediate shaft renders the whole kinematism more compact and the transmission of power more efficient.

[0024] Furthermore, at least one transmission shaft and one reduction kinematism are comprised in the drive mean, and not in the reducing mean, as happens in the state of the art.

[0025] In this way, substantially any type of electric motor can be used, for example of the type normally used in the automotive field, even though it normally has torque values much lower than those necessary for the correct movement of the door.

[0026] Indeed, thanks to the variations in torque and speed achieved by the reduction kinematisms according to the present invention, these values are found at exit on the fourth transmission shaft, and can be effectively exploited by the door, for its correct movement, and also for the movement of very long or heavy leafs.

[0027] Furthermore, the first transmission kinematism, being associated directly with the electric motor, effects the first variation outside the reducer mean, thus providing the reducer mean with a motion with values of torque and speed that are already varied with respect to the nominal ones at exit from the drive shaft.

[0028] With the present invention, it is therefore possible to use low cost and reduced size electric motors, and to provide in any case the necessary torque to move the door, even a big one, thanks to the first variation made outside the reducer, and thanks also to the new kinematic reduction combination, while keeping the installation costs and bulk limited.

[0029] Furthermore, simply by replacing the electric motor and/or the relative first reduction kinematism, it is possible to use at least the same reducing mean, even for different technical and operating conditions of use.

[0030] According to a variant, the present invention comprises at least a connection joint connected both to the first transmission shaft and also to the second transmission shaft, in order to achieve the mechanical connection between the two.

[0031] According to a variant, the first reduction kinematism comprises at least a screw element connected coaxially with the drive shaft, and a coordinated pulley engaging with the screw element and keyed coaxially onto the first transmission shaft.

[0032] According to another variant, the second reduction kinematism comprises a grooved profile made on the second transmission shaft, and a coordinated toothed wheel engaging with the grooved profile and mounted idle on the fourth transmission shaft.

[0033] According to another variant, the third reduction kinematism comprises at least a first toothed wheel coaxially and angularly constrained to the toothed wheel of the second reduction kinematism and mounted idle on the fourth transmission shaft, and a coordinated second toothed wheel engaging with the relative first toothed wheel and keyed onto the third transmission shaft.

[0034] According to another variant, the fourth reduction kinematism comprises a grooved profile made on the third transmission shaft, and a coordinated toothed wheel engaging with the grooved profile and keyed onto the fourth transmission shaft.

[0035] According to another variant, the drive shaft of the electric motor is disposed substantially orthogonal to the relative first transmission shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 shows schematically an example of a door to which a drive member according to the present invention is applied;
- fig. 2 shows schematically the drive member in fig. 1, in an assembled condition;
- fig. 3 shows schematically the drive member in fig.

1, in a partly dis-assembled condition.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0037] With reference to the attached drawings, a drive member according to the present invention is indicated in its entirety by the reference number 10, and is applied in this case to move a main door 11 with a panel 12, in this case of the leaf type.

[0038] The drive member 10 comprises a drive unit 13 and a reducing unit 15, mechanically connected to each other.

[0039] The drive unit 13 comprises an electric motor 16, of the type normally used in the automotive sector, and having for example a nominal power of about 30 W, so as to generate a motion having a torque of about 8 Nm and a speed of about 60 rpm.

[0040] The electric motor 16 comprises at outlet a drive shaft 17 through which it transmits to the outside the motion generated.

[0041] The drive unit 13 also comprises a first kinematism 19, which is provided with a screw element 20 and a pulley 21, engaging with the screw element 20.

[0042] The screw element 20 is keyed coaxially onto the drive shaft 17, to take the motion generated by the electric motor 16 directly from said drive shaft 17, while the pulley 21 is keyed to a first transmission shaft 22.

[0043] The first transmission shaft 22 is disposed substantially orthogonal to the drive shaft 17.

[0044] The motion arriving from the drive shaft 17 is transferred to the first transmission shaft 22 with a first variation of the ratios of torque and speed with respect to the nominal values at exit from the drive shaft 17.

[0045] In this case, the transmission ratio between the screw element 20 and the pulley 21 is for example about 1:69.

[0046] The reducing unit 15 is attached on board the panel 12 by means of a protection shield and relative brackets, of a substantially known type and not shown in the drawings.

[0047] The reducing unit 15 comprises a second transmission shaft 23, coaxially constrained to the first transmission shaft 22 by means of a joint 25, so as to achieve the mechanical connection of the drive unit 13 and the reducing unit 15.

[0048] The reducing unit 15 also comprises a second kinematism 26, which is provided with a grooved profile 27 made directly on the second transmission shaft 23, and a relative toothed wheel 29, engaging with the grooved profile 27.

[0049] The toothed wheel 29 is mounted idle on a fourth transmission shaft 39, which will be described in more detail hereafter.

[0050] The motion arriving from the first transmission shaft 22 and hence from the second transmission shaft 23, is subjected to a second variation in the torque and speed ratios.

[0051] In this case the transmission ratio between the grooved profile 27 and the toothed wheel 29 is for example about 9:56.

[0052] The reducing unit 15 also comprises a third kinematism 30, which is provided with a first toothed wheel 31 constrained coaxially and angularly to the toothed wheel 29 so as to take motion from the latter, and with a second toothed wheel 32, engaging with the first toothed wheel 31.

[0053] The first toothed wheel 31, like the toothed wheel 29, is mounted idle on a fourth transmission shaft 39, while the second toothed wheel 32 is keyed onto a third transmission shaft 33.

[0054] The third transmission shaft 33 is substantially parallel to the second transmission shaft 23.

[0055] The motion arriving from the toothed wheel 29 is transferred to the third transmission shaft 33, with a first variation in the ratios of torque and speed with respect to the nominal values at exit from the toothed wheel 29.

[0056] In this case, the transmission ratio between the first toothed wheel 31 and the second toothed wheel 32 is for example about 24:46.

[0057] The reducing unit 15 also comprises a fourth kinematism 35, which is provided with a grooved profile 36 made directly on the third transmission shaft 33, and a relative toothed wheel 37, engaging with the grooved profile 36.

[0058] The toothed wheel 37 is keyed onto the fourth transmission shaft 39 with respect to which motion is taken for the movement of the panel 12 of the door 11.

[0059] The third transmission shaft 33 and the fourth transmission shaft 39 are substantially parallel to each other.

[0060] The fourth transmission shaft 39 is disposed in an intermediate position between the second transmission shaft 23 and the third transmission shaft 33.

[0061] The motion arriving from the third transmission shaft 33 is subjected to a fourth variation in the torque and speed ratios before being transmitted to the fourth transmission shaft 39.

[0062] In this case, the transmission ratio between the grooved profile 36 and the toothed wheel 37 is for example about 11:42.

[0063] In this way, starting from torque and speed values equal to about 8 Nm and about 60 rpm, at exit from the electric motor 16, we obtain torque and speed values equal to about 370 Nm and about 1.3 rpm at exit from the fourth transmission shaft 39.

[0064] It is clear, however, that modifications and/or additions of parts may be made to the drive member 10 as described heretofore, without departing from the field and scope of the present invention.

[0065] For example, it comes within the field of the present invention to provide a mechanical release device for the manual opening of the panel 12. With the mechanical disposition of the components according to the present invention, the mechanical release device can be

operationally associated without distinction with any one of the transmission shafts 22, 23, 33, 39.

[0066] It also comes within the field of the present invention to provide that the first and second transmission shaft 22, 23, instead of being connected with each other mechanically by the joint 25, are made in a single piece.

[0067] It is also clear that, although the present invention has been described with reference to specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of drive member for a door or main door, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Drive member for a door or main door, comprising at least a drive mean (13) able to generate a motion having a determinate torque and a determinate speed, and a reducing mean (15) able to be connected on one side to the output of said drive mean (13) and, on the other side, to said door (11), in order to vary in a desired manner the values of torque and speed of the motion generated by said drive mean (13), so as to determine the correct movement of said door (11), **characterized in that** said drive mean (13) comprises an electric motor (16) having a drive shaft (17) able to transmit said motion, and a first reduction kinematism (19) directly connected mechanically to said drive shaft (17) and able to determine a first variation in the ratios of torque and speed of the motion, in order to transmit them to an associated first transmission shaft (22), and **in that** said reducing mean (15) comprises:

   - a second transmission shaft (23), or input shaft, mechanically connected and coaxial to said first transmission shaft (22);
   - a second reduction kinematism (26) mechanically connected to said second transmission shaft (23), and able to determine a second variation in the ratios of torque and speed of the motion;
   - a third reduction kinematism (30) kinematically connected to said second reduction kinematism (26), and able to determine a third variation in the ratios of torque and speed of the motion;
   - a third transmission shaft (33), or intermediate shaft, mechanically connected to said third reduction kinematism (30);
   - a fourth reduction kinematism (35) mechanically connected to said third transmission shaft (33), and able to determine a fourth variation in the ratios of torque and speed of the motion; and
   - a fourth transmission shaft (39), or output shaft, mechanically connected to said fourth reduction kinematism (35), and to which said door (11) is able to be mechanically connected;

   wherein the output shaft (39) is located in an intermediate position between the input shaft (23) and the intermediate shaft (33).

2. Drive member as in claim 1, **characterized in that** it comprises at least a connecting joint (25) connected both to said first transmission shaft (22), and also to said second transmission shaft (23), in order to achieve the mechanical connection between the two.

3. Drive member as in claim 1 or 2, **characterized in that** said first reduction kinematism (19) comprises at least a screw element (20) connected coaxially to said drive shaft (17), and a coordinated pulley (21) engaging with said screw element (20) and keyed coaxially onto said first transmission shaft (22).

4. Drive member as in any claim hereinbefore, **characterized in that** said second reduction kinematism (26) comprises a grooved profile (27) made on said second transmission shaft (23), and a coordinated toothed wheel (29) engaging with said grooved profile (27) and mounted idle on said fourth transmission shaft (39).

5. Drive member as in claim 4, **characterized in that** said third reduction kinematism (30) comprises at least a first toothed wheel (31) coaxially and angularly constrained to said toothed wheel (29) of the second reduction kinematism (26) and mounted idle on said fourth transmission shaft (39), and a coordinated second toothed wheel (32) engaging with the relative first toothed wheel (31) and keyed onto said third transmission shaft (33).

6. Drive member as in claim 5, **characterized in that** said fourth reduction kinematism (35) comprises a grooved profile (36) made on said third transmission shaft (33), and a coordinated toothed wheel (37) engaging with said grooved profile (36) and keyed onto said fourth transmission shaft (39).

7. Drive member as in any claim hereinbefore, **characterized in that** said drive shaft (17) is disposed substantially orthogonal to said first transmission shaft (22).

8. Drive member as in any claim hereinbefore, **characterized in that** said first transmission shaft (22), said second transmission shaft (23), said third transmission shaft (33) and said fourth transmission shaft (39) are substantially parallel to each other.

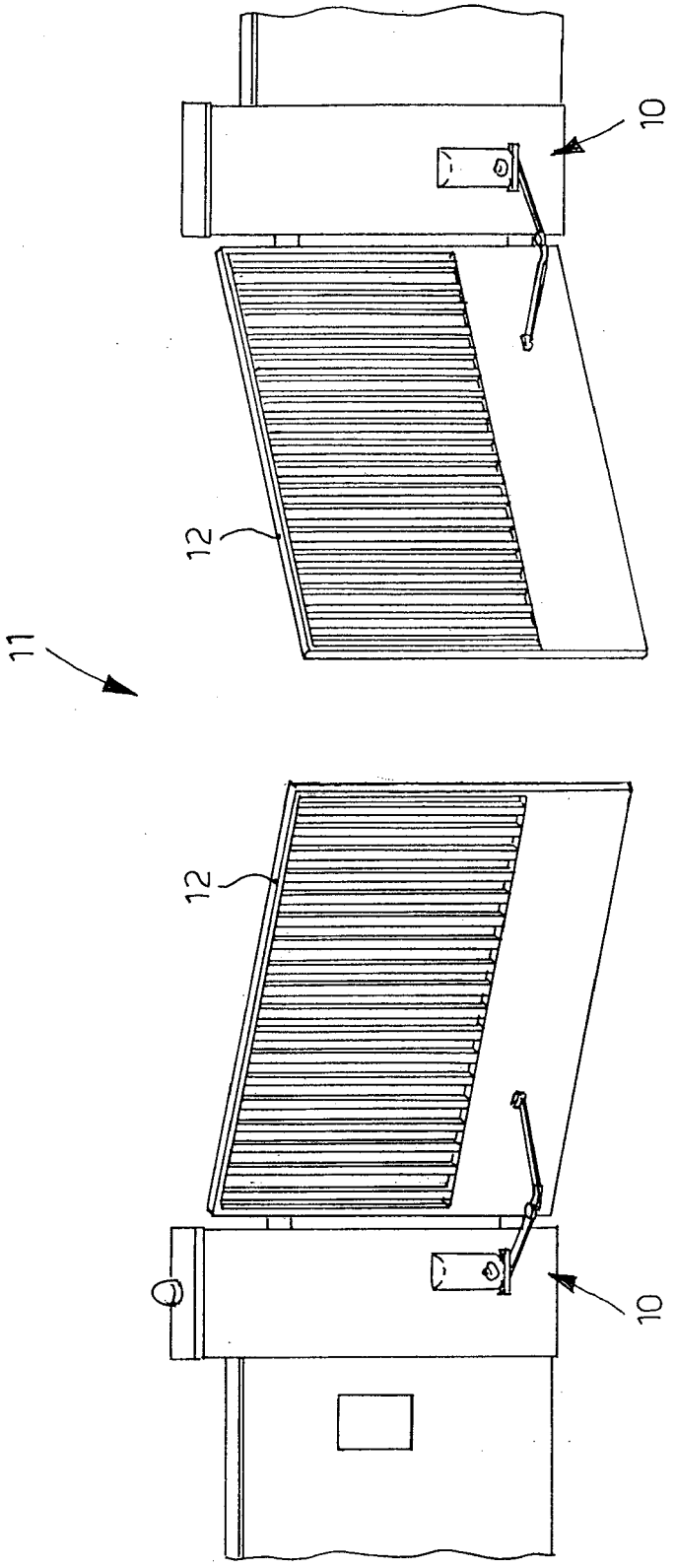

fig. 1

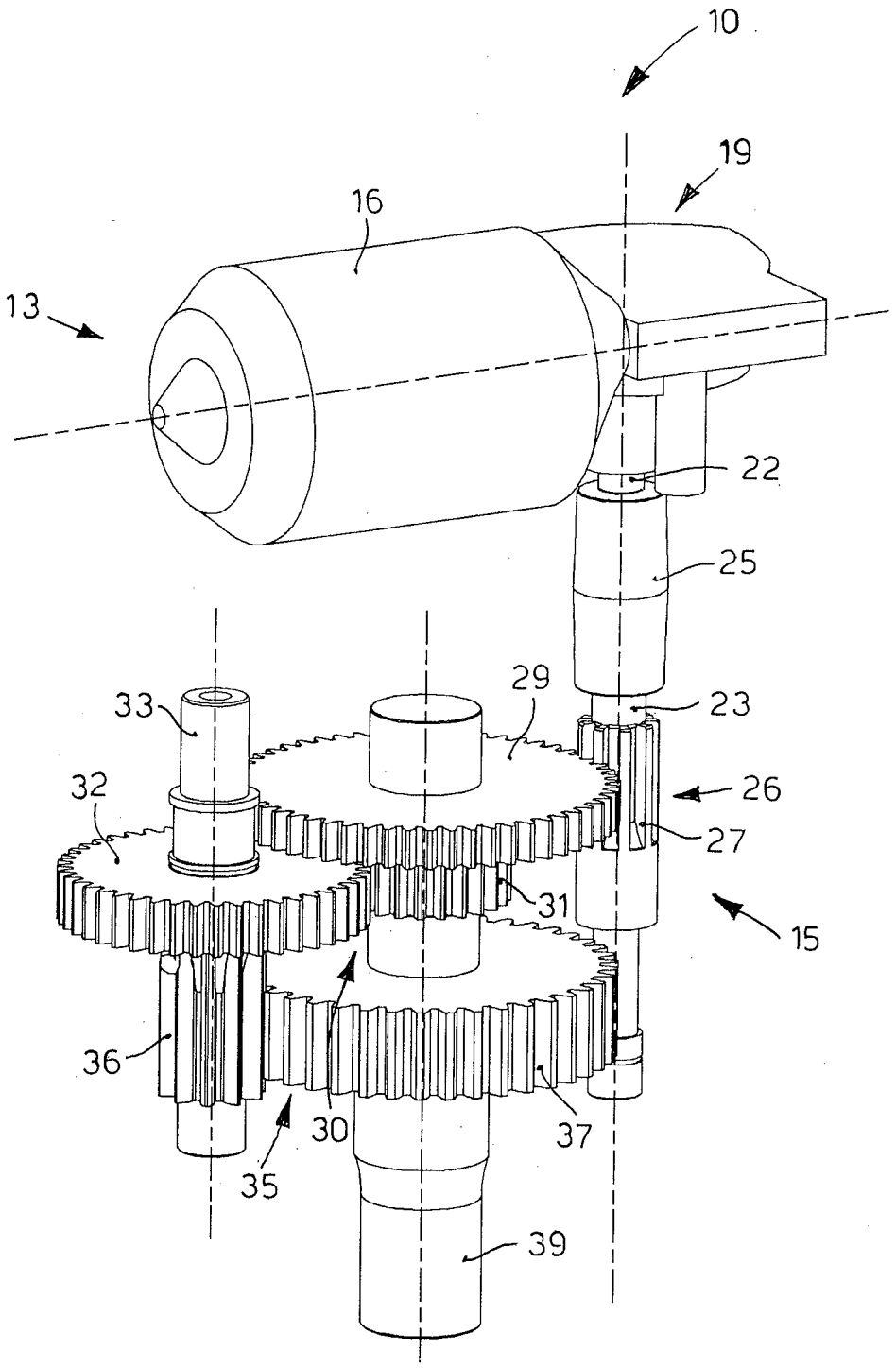

fig. 2

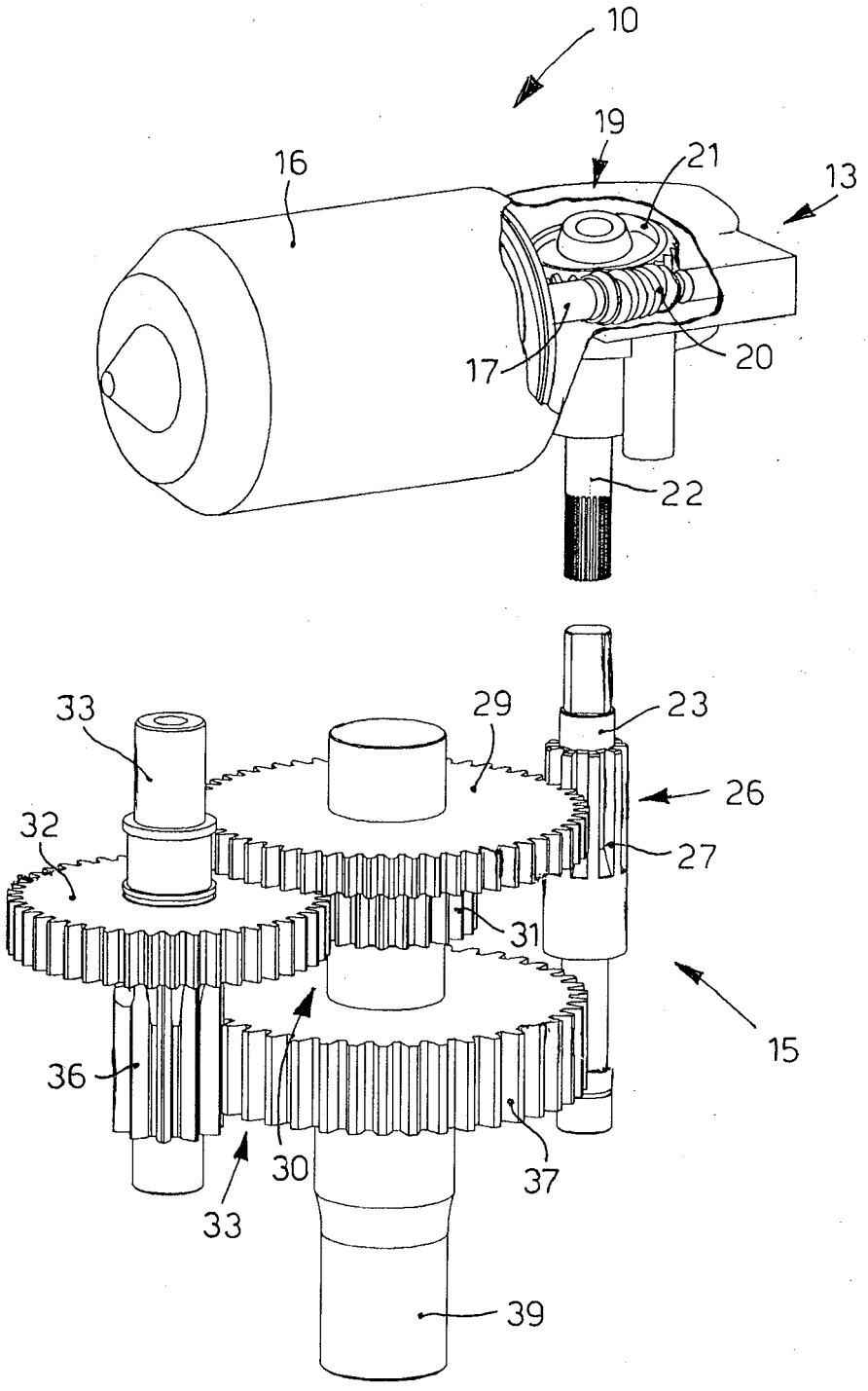

fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 6174

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 1 057 063 A (NIHON BUNKA ROLLER SHUTTER COM) 1 February 1967 (1967-02-01) * page 2, line 91 - page 3, line 4; figure 1 * -----	1,4-8 2-3	INV. E05F15/10 E05F15/12
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A	US 2007/295136 A1 (FLEMING MATTHEW C [US]) 27 December 2007 (2007-12-27) * figure 1 * -----	4,6	

TECHNICAL FIELDS SEARCHED (IPC)
E05F F16H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 March 2010	Witasse-Moreau, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

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01-03-2010

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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