(11) Application No. AU 2007246782 B2

(19) AUSTRALIAN PATENT OFFICE

(54) Title

Electric motor with a low number of revolutions, in particular to drive lifting devices

(51)[6] International Patent Classification(s)

H02K 7/10 (2006.01) 11/04

B66B 11/04 (2006.01) 20060101ALI2007111

H02K 19/10 (2006.01) 5BHEP **H02K**

H02K 7/10 19/10

20060101AFI2007111 20060101ALI2007111

5BHEP **B66B** 5BHEP

PCT/IB2007/000669

(21) Application No: 2007246782 (22) Application Date: 2007.03.19

(87) WIPO No: WO07/129150

(30) Priority Data

(31) Number	(32) Date	(33) Country
BZ2006A000018	2006.05.09	IT
BZ2006A000015	2006.04.28	IT
TN2006A000007	2006.05.10	IT

(43) Publication Date : 2007.11.15

(71) Applicant(s)

Giorgio Jezek

(72) Inventor(s)

Jezek, Giorgio

(74) Agent/Attorney

Fisher Adams Kelly, Level 29 12 Creek Street, Brisbane, QLD, 4000

(56) Related Art

EP 0 695 662

GB 1 359 351

EP 1 642 858

US 2002/171305

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2007 (15.11.2007)

PCT

(10) International Publication Number
WO 2007/129150 A1

(51) International Patent Classification:
H02K 7/10 (2006.01) *B66B 11/04* (2006.01)
H02K 19/10 (2006.01)

(21) International Application Number:
PCT/IB2007/000669

(22) International Filing Date: 19 March 2007 (19.03.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

BZ2006A000015	28 April 2006 (28.04.2006)	IT
BZ2006A000018	9 May 2006 (09.05.2006)	IT
TN2006A000007	10 May 2006 (10.05.2006)	IT

(71) Applicant and
(72) Inventor: **JEZEK, Giorgio** [IT/IT]; Via Ponte Alto, 45, I-38050 Cognola de Trento (IT).

(74) Agent: **DE ANNA, Pier Luigi**, Notarbartolo & Gervasi GmbH, Bavariaring 21, 80336 Munich (DE).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

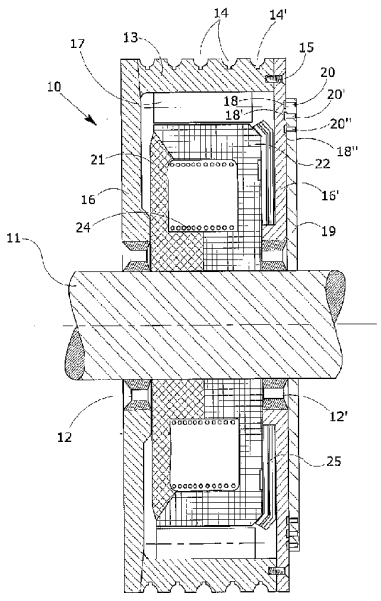
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 2007/129150 A1

(54) Title: ELECTRIC MOTOR WITH A LOW NUMBER OF REVOLUTIONS, IN PARTICULAR TO DRIVE LIFTING DEVICES



(57) Abstract: An electric motor (10) with a low number of revolutions comprises a rotor (17) powered by three-phase alternating voltage, a series of magnets (21, 22) and a coil forming a stator (24), in which the rotor (17) and the stator (24) have the same number of magnetic poles. The stator (24) is powered with direct voltage, and the frequency of the rotor voltage (17) is varied to obtain a predetermined number of rpm of the motor and to vary the acceleration and deceleration conditions of the motor. A thrust bearing opposes the effort of the falling brake disc.

Electric motor with a low number of revolutions, in particular to drive lifting devices.

* * * * *

Technical field

This invention refers to an electric motor with a low number of revolutions.

In particular, this invention refers to an electric motor with a low number of revolutions which can be advantageously used for applications requiring torque.

By way of example, the electric motor according to the invention can be used to drive lifting devices, such as lifts.

Background art

Electric motors used in applications with a heavy torque requirement, for example electric motors for lifts, are generally positioned inside relatively small spaces, which is a source of problems as the motors are usually fairly large due to the presence, in addition to the motor itself, of a reduction unit and obviously the pulley around which the cables that raise and lower the lift cabin are wound.

The reduction units used in these applications often have electromechnical characteristics that are fairly inconstant over time, leading to functioning irregularities that cause a considerable reduction in the performance of the motor.

Description of the invention

This invention proposes to provide a solution to the background art problems, thanks to a new design of motor which is small and is not equipped with a reduction unit.

In particular, in the lifts sector, this invention proposes to provide an electric motor with a low number of revolutions (for example a motor with approximately 50 rpm corresponding to a lifting speed of around 1 m/sec) thanks to which the components necessary for the movement and the braking of the machine can be directly contained inside the drive pulley.

This is achieved by means of an electric motor with the features described in the main claim. The dependent claims describe particularly advantageous embodiments of the electric motor according to the invention.

The most typical configuration of the electric motor according to the invention consists of a rotor (with a high number of magnetic poles) powered by three-phase alternating voltage, and of a stator with the same number of magnetic poles as the rotor, created by a coil powered by direct voltage.

According to a particularly advantageous embodiment of the invention, the direct voltage consists of a single-phase rectified and thus pulsating alternating voltage. This direct voltage makes it possible to obtain excellent results in terms of motor performance.

Description of the drawings

Other features and advantages of the invention will become clear on reading the description of some

embodiments of the invention, given as non-binding examples, with the help of the accompanying drawing which shows a cross-section of an electric motor according to the invention.

Description of some embodiments of the invention

In the figure, the reference number 10 indicates overall an electric motor with a low number of revolutions used to drive lifting devices according to the invention.

The motor 10 is supported by a fixed metal shaft 11 by means of a pair of bearings 12, 12' (either roller or ball bearings) and is enclosed in the casing 13 of a pulley, the outer surface of which is equipped with a series of slots 14, 14' ... designed to accommodate cables (not shown in the figure) for driving a lifting device, for example a lift. The casing 13 is rigidly fixed by means of screws 15 to a pair of diamagnetic side plates 16, 16' which work in conjunction with the said roller bearings 12, 12'.

The actual electric motor is housed inside the space formed by the diamagnetic plates 16, 16' and the pulley casing 13.

In particular, integral with the inner surface of the pulley 13 is a rotor pack 17 fitted with a series of slots (not shown in the figure) designed to accommodate a three-phase winding powered by alternating voltage. This three-phase winding is connected to three respective conductor rings 18, 18', 18" inserted in appropriate slots cut in the side plate 16'. In addition, a protective guard 19 consisting of two

portions joined together and fixed to the shaft 11 supports three respective brushes 20, 20', 20" in contact with the said conductor rings 18, 18', 18".

Respective magnets 21, 22 are positioned next to each other and fixed to the shaft 11. These magnets 21, 22 define a space which houses a stator-powered coil 24 powered by direct voltage in order to create the magnetic polarities of the stator.

Finally, the motor 10 comprises an electromagnetic brake 25 consisting of a pair of metal discs, one of which is integral with the side plate 16' and the other with the magnet 22, and of disc-pushing springs contained in appropriate slots cut in the magnet 22.

Such a motor is particularly suited for application as a machine without a reduction unit in the lifts sector, since the drive pulley can contain all the equipment necessary both to move and to brake the machine.

According to the invention, the respective power supplies of the stator coil 24 (advantageously direct voltage obtained by rectifying single-phase alternating voltage) and of the rotor windings 17 (three-phase alternating voltage) are governed by means of an appropriate control device, until the required number of revolutions is reached, which depends on the number of poles of the motor and on the frequency of the three-phase power supply.

The control device that can be used for these applications is the variable frequency type, for example the ac-dc-ac or dc-ac type.

According to the invention, the stator coil 24 is

powered by direct voltage. In this embodiment, the motor comprises a high number of magnetic poles, both stator and rotor having the same number, and in the stator the poles are the clawed type as in automobile alternators. Some features of the synchronous motor in terms of performance are lost in this case, achieving however an acceleration torque that makes it possible to obtain the required number of revolutions from the rotor by merely varying the frequency of the three-phase power supply of the rotor itself.

In order to avoid flow leakage between the driving shaft and the coil, the side plates 16, 16' are made from diamagnetic material.

As far as the steady state speed and the braking and acceleration phases are concerned, the stator 24 is constantly powered by direct voltage, while the rotor 17 has a variable frequency achieved by means of a frequency converter external to the rotor. In this case, during the acceleration and deceleration phases the frequency of the three-phase voltage of the rotor 17 is adjusted by frequency converters (ac-dc-ac or dc-ac) which provide the frequencies, currents and thus the torques required.

The invention is described above with reference to a preferred embodiment, in which the main shaft is fixed, the stator is integral with the shaft and the rotor turns around the shaft and the stator.

Embodiments of this invention are nevertheless foreseen in which the conformation of the motor is inverted, and the main shaft rotates, while the motor casing integral with the three-phase windings is fixed.

In this case, the main shaft is equipped with a pair of conductor rings connected to appropriate cables inserted in slots in the shaft and connected to windings of the coil and of the rotating magnets.

A pair of brushes is then connected to the rings for transmission of the current, while the mechanical drive organs, in particular the lifting organs, are connected to the main shaft.

2007246782 02 Jul 2010

CLAIMS:

1. An electric motor for a low number of revolutions comprising a rotor, three phase alternating voltage power supply means of the rotor, a stator formed of a series of magnets made from ferrous material and a coil, and a brake system, in which the rotor and the stator have the same number of magnetic poles, said rotor, the stator and the magnets are enclosed in a pulley casing which rotates around a fixed shaft, said rotor being fixed to the pulley casing, the coil of the stator is powered by direct voltage, the frequency of the rotor voltage is variable, and the magnets forming the stator are fixed to the shaft and designed to accommodate the coil of the stator, wherein:

- said pulling case comprises a pulley and a pair of diamagnetic side plates rigidly fixed the pulley;
- said brake system is enclosed in said pulley casing and comprises an electromagnetic brake consisting of a pair of metallic discs and disc-pushing springs, one of said discs being integral with one of said diamagnetic plates and the other of said discs being integral with the magnet which produce the poles of the stator, and said disc-pushing springs being located in appropriate slots cut in said magnet integral with said disc.

2. An electric motor according to claim 1, wherein the two brake discs have a concave shape consisting of a central discoid section having at his periphery a section in the shape of a truncated cone.

3. An electric motor according to claim 1, wherein said diamagnetic side plates work in conjunction with a pair of roller bearings cooperating with said shaft.

2007246782 02 Jul 2010

4. An electric motor according to claim 1, wherein said motor also comprises a fixed protective guard fitted with a series of brushes connected to respective rings rotating with the pulley casing, a electrically connected to the three-phase rotor windings.

5. An electric motor according to claim 1, wherein said pulley casing presents a series of peripheral slots designed to accommodate drive cables.

6. An electric motor according to claim 1, wherein said motor also internally comprises a mechanical brake unit.

7. An electric motor according to claim 1, wherein said rotor and stator are integral with a motion transmission organ.

8. An electric motor according to claim 7, wherein said motion transmission organ consists of a toothed wheel or a friction wheel.

9. An electric motor as hereinbefore described with reference to the drawing.

1/1