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Canadian Intellectual Property Office

CA 2927065 C 2022/05/17

(11)(21) **2 927 065**

(12) **BREVET CANADIEN**
CANADIAN PATENT

(13) **C**

(86) **Date de dépôt PCT/PCT Filing Date**: 2014/10/20
(87) **Date publication PCT/PCT Publication Date**: 2015/05/07
(45) **Date de délivrance/Issue Date**: 2022/05/17
(85) **Entrée phase nationale/National Entry**: 2016/04/12
(86) **N° demande PCT/PCT Application No.**: EP 2014/002821
(87) **N° publication PCT/PCT Publication No.**: 2015/062708
(30) **Priorité/Priority**: 2013/10/31 (DE10 2013 018 271.9)

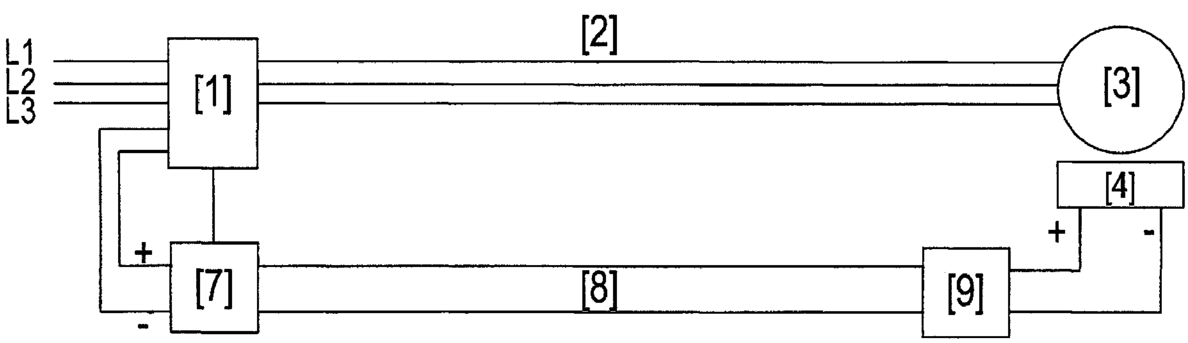
(51) **Cl.Int./Int.Cl.** *H02P 3/04* (2006.01), *H02P 27/16* (2006.01), *H02H 7/08* (2006.01), *H04B 3/54* (2006.01)

(72) **Inventeurs/Inventors**:
SCHMIDT, JOSEF, DE;
GEISSLER, MICHAEL, DE;
SLISKOVIC, MAJA, DE;
GROSS, DIETER, DE;
BOECKLE, JUERGEN, DE

(73) **Propriétaire/Owner**:
SEW-EURODRIVE GMBH & CO. KG, DE

(74) **Agent**: CPST INTELLECTUAL PROPERTY INC.

(54) Titre : SYSTEME D'ENTRAINEMENT A FREIN ELECTROMAGNETIQUE
(54) Title: DRIVE SYSTEM WITH ELECTROMAGNETICALLY ACTUATABLE BRAKE



(57) **Abrégé/Abstract**:
A drive system, having a power converter and a motor powered from the power converter via supply leads,

an electromagnetically actuatable brake being disposed on the motor,

the brake being able to be supplied and therefore being controllable from an AC/DC converter, which is powered via lines from a DC/AC converter that is powered and/or controlled by signal electronics of the power converter.

Abstract:

A drive system, having a power converter and a motor powered from the power converter via supply leads,

an electromagnetically actuatable brake being disposed on the motor,

the brake being able to be supplied and therefore being controllable from an AC/DC converter, which is powered via lines from a DC/AC converter that is powered and/or controlled by signal electronics of the power converter.

DRIVE SYSTEM WITH ELECTROMAGNETICALLY ACTUATABLE BRAKE

TECHNICAL FIELD

[0001] The present invention relates to a drive system.

BACKGROUND

[0002] It is generally known that a drive system has a converter-fed electric motor.

[0003] Therefore, the object of the present invention is to further develop a device and a method, in doing which, the intention being to ensure a reliable and trouble-free brake supply.

[0004] According to the present invention, the objective is achieved in the drive system having the features set forth herein.

SUMMARY

[0005] Important features of the present invention with regard to the drive system are that it has a power converter and a motor powered from the power converter via supply leads, an electromagnetically actuatable brake being disposed on the motor, the brake being able to be supplied and therefore being controllable from an AC/DC converter, which is powered via lines from a DC/AC converter that is powered and or controlled by signal electronics of the power converter.

[0006] The advantage in this context is that the brake is able to be controlled largely independently of the system voltage. The reason is that even in the event of voltage fluctuations on the network side, with the aid of the DC/AC converter, an AC voltage is able to be generated that is usable for controlling the brake. Preferably a low voltage with a frequency between 10 kHz and 1000 kHz is used as AC voltage.

[0007] In one advantageous development, the lines and the supply leads are disposed in one common cable, in particular, the lines being twisted together. This has the advantage that

[0008] In one advantageous embodiment, the signal electronics of the power converter include a data-coupling means by which signals are able to be modulated upon the lines or demodulated, the AC/DC converter having a data-coupling means by which signals are able to be modulated upon the lines or demodulated, the data-coupling means of the AC/DC converter being connected to signal electronics that are integrated on the motor, in particular, are integrated

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in the terminal box of the motor. This is advantageous because not only is the brake able to be supplied, but also the brake-control information is able to be transmitted with the aid of the lines.

[0009] In one advantageous refinement, an STO (safe torque off) detector is connected to the signal electronics integrated in the motor, the STO detector monitoring the voltage curves present on at least two of the three or on the three supply leads on the motor side, so that in the event of a line break and/or fault in the power converter, the brake is able to be applied. The advantage here is that upon loss of the rotating magnetic field generated by the power converter, the STO detector detects this loss and controls the brake in such a way that it is applied.

[0010] In one advantageous development, a rotor-angle sensor and/or a sensor device, especially including temperature sensor, structure-borne noise sensor and/or torque sensor, is/are disposed with the signal electronics integrated on the motor. The advantage in this case is that the sensor signals are evaluable by signal electronics, which are integrated in the motor. In this context, the brake is able to be controlled with the aid of these signal electronics as a function of the sensor signals. In further refinement, the sensor signals are even able to be transmitted to the power converter.

[0011] The present invention is not limited to the combination of features in the claims. Further useful combination possibilities of claims and/or individual claim features and/or features of the specification and/or of the figures are apparent to one skilled in the art, particularly from the problem definition and/or the objective set by comparison to the related art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The present invention will now be explained in greater detail with reference to the drawing:

[0013] In Figure 1, a first drive system according to the present invention is sketched schematically, having an electric motor 3 without an angle-sensing system.

[0014] In Figure 2, a second drive system according to the present invention is sketched schematically, in which in contrast to Figure 1, a rotor-angle sensor 5 is disposed on electric motor 3.

[0015] In Figure 3, a third drive system according to the present invention is sketched schematically, in which in contrast to Figure 2, an STO detector is provided.

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DETAILED DESCRIPTION

[0016] As shown in Figure 1, electric motor 3 is fed from a power converter 1, especially from a voltage-commutated frequency converter, via a cable 2 having supply leads.

[0017] The supply leads are implemented as three-phase current lines, so that on the output side, power converter 1 makes a three-phase voltage available, which powers motor 3.

[0018] The power converter is supplied from network phases (L1, L2, L3), the system voltage being rectified, and an inverter being supplied from the unipolar voltage thus generated. The inverter has three half-bridges made up of power semiconductor switches, driven in pulse-width modulated fashion, for generating the output-side three-phase voltage system powering the motor.

[0019] Disposed on motor 3 is an electromagnetically actuatable brake 4 by which the rotor shaft of motor 3 is able to be braked. To that end, brake 4 has a coil, upon whose energizing, an armature disk is drawn toward the coil against the spring force generated by a spring element, and the brake is thus released.

[0020] When the coil is not energized, the armature disk is pressed by the spring element onto an axially displaceable brake-pad carrier that is joined in rotatably fixed fashion to the rotor shaft and is pressed onto a braking surface.

[0021] During energizing, the coil of brake 4 is fed from the DC-side output of an AC/DC converter 9, especially rectifier, whose input-side AC voltage is made available via lines 8, especially twisted lines, from a DC/AC converter 7.

[0022] Preferably, this DC/AC converter 7 is integrated in power converter 1, thus, is disposed in the housing of the power converter and is powered from a DC voltage generated by the power converter.

[0023] DC/AC converter 7 is implemented as an infeed unit controlled by power converter 1, so that brake 4 is controllable by the infeed unit. The brake is released or applied as a function of the AC voltage thus present or not present at the output of DC/AC converter 7.

[0024] Preferably, lines 8 are integrated in cable 2. In this context, lines 8 are implemented as low-voltage lines, and the supply leads are implemented as medium-voltage lines.

[0025] As shown in the exemplary embodiment according to Figure 2, also disposed on motor 3 is a rotor-angle sensor 5, by which the angular position of the rotor shaft of motor 3 is detectable. In addition, a further sensor device 6, especially including a temperature sensor, structure-borne noise sensor and/or torque sensor, is disposed on the motor, so that values of one or more corresponding physical variables are also detectable. Further sensor device 6 and rotor-angle sensor 5 are connected to signal electronics 11, which are fed from AC/DC converter 9. Signal electronics 11 transmit data via lines 8, by capacitively coupling the data onto lines 8 in the AC/DC converter, so that a corresponding coupling means is thus integrated in the AC/DC converter. On the power converter side, the data are decoupled by data-coupling means 10 and conducted via a communication interface COM.

[0026] The brake-control signal, likewise coupled by data-coupling means 10 onto lines 8, is transmitted to AC/DC converter 9, which makes the supply voltage available for the coil of brake 4 as a function of the brake-control signal.

[0027] The data transmitted via communication interface COM to power converter 1 is taken into account and/or further processed by the signal electronics of power converter 1.

[0028] As shown in the exemplary embodiment according to Figure 3, in addition, an STO detector 13 is provided which monitors the three-phase voltage present on the supply leads of cable 2. In this context, either only two of the phase voltages of the three-phase voltage system are monitored, as shown in Figure 3, or alternatively, all three phase voltages of the three-phase voltage system are monitored. The phase voltages are detected capacitively, thus, are transmitted to the STO detector with the aid of a coupling means 12. Consequently, in the case of constant voltage or vanishing voltage on the respective phase, no voltage is detectable by STO detector 13. Therefore, if an STO signal, thus, a safe torque off signal, is implemented at power converter 1, this is detectable by STO detector 13, and the supply voltage of brake 4 is reliably switched off by switching off the AC/DC converter accordingly. Reliability is increased owing to the evaluation of the pulse pattern with the aid of STO detector 13 directly on motor 3, since power converter 1 and the motor cable are monitored during normal operation as well, and therefore in response to a line break or fault condition in power converter 1, brake 4 is driven by STO detector 13 via the AC/DC converter in such a way that brake 4 is applied.

[0029] The motor voltage, thus, the voltage of the power converter generated on the output side, is detectable by STO detector 13 during normal operation, as well.

[0030] Safety function STO thus relates to a reliable switch-off of the torque.

LIST OF REFERENCE NUMERALS

1 Power converter, especially voltage-commutated frequency converter

2 Cable, including supply leads

3 Electric motor

4 Electromagnetically actuatable brake

5 Rotor-angle sensor

6 Sensor device, especially including temperature sensor, structure-borne noise sensor and/or torque sensor

7 DC/AC converter

8 Lines, especially twisted lines

9 AC/DC converter, especially rectifier

10 Data-coupling means

11 Signal electronics

12 Coupling means

13 STO detector

L1 Network phase

L2 Network phase

L3 Network phase

What is claimed is:

1. A drive system, comprising:

a power converter;

a motor powered from the power converter via supply leads;

an electromagnetically actuatable brake disposed on the motor;

an AC/DC converter adapted to supply and control the brake; and

a DC/AC converter powered, controlled, or powered and controlled by signal electronics of the power converter, the DC/AC converter adapted to power the AC/DC converter via lines connected between the DC/AC converter and the AC/DC converter.

2. The system according to claim 1, wherein the lines and the supply leads are disposed in a common cable.

3. The system according to claim 2, wherein the lines and supply leads are twisted together.

4. The system according to claim 1, wherein the signal electronics of the power converter include a data-coupling device adapted to modulate, demodulate or modulate and demodulate signals upon the lines, the AC/DC converter having a data-coupling devices adapted to modulate, demodulate or modulate and demodulate signal upon the lines, the data-coupling device of the AC/DC converter being connected to signal electronics that are integrated on the motor.

5. The system according to claim 4, wherein the signal electronics are integrated in a terminal box of the motor.

6. The system according to claim 1, further comprising a safe torque off (STO) detector connected to the signal electronics integrated in the motor, the STO detector adapted to monitor voltage curves present (a) on at least two of three or (b) on three supply leads on a motor side, so that in the event of a line break, fault, or line break and fault in the power converter, the brake is able to be applied.

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7. The system according to claim 1, further comprising a rotor-angle sensor, a sensor device, or a rotor-angle sensor and a sensor device disposed with the signal electronics integrated on the motor.

8. The system according to claim 7, wherein the sensor device includes at least one of a temperature sensor, a structure-borne noise sensor, and a torque sensor.

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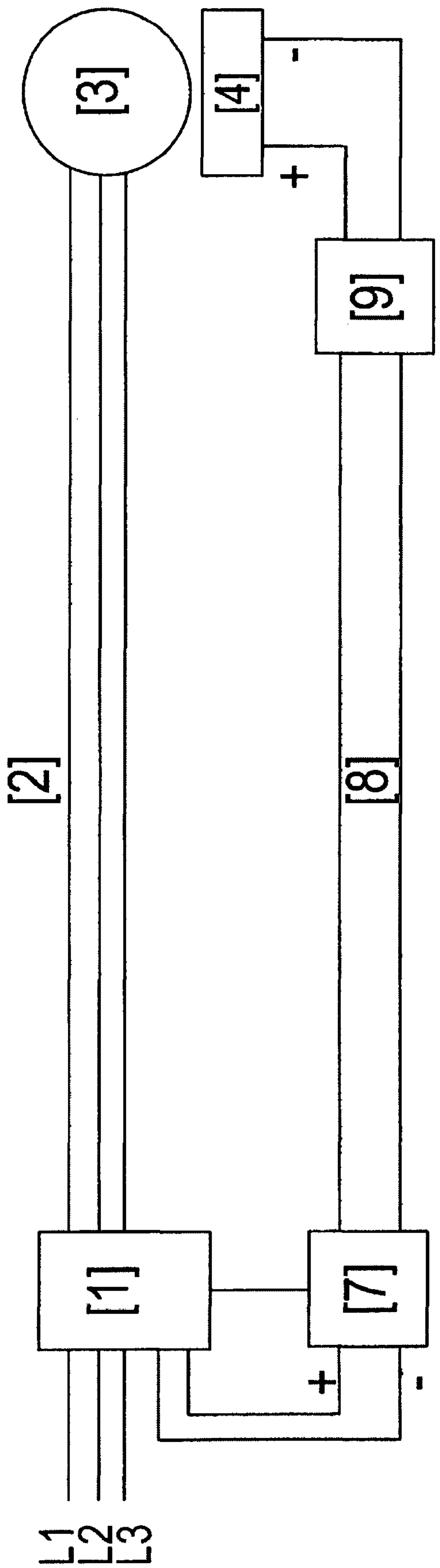


Fig. 1

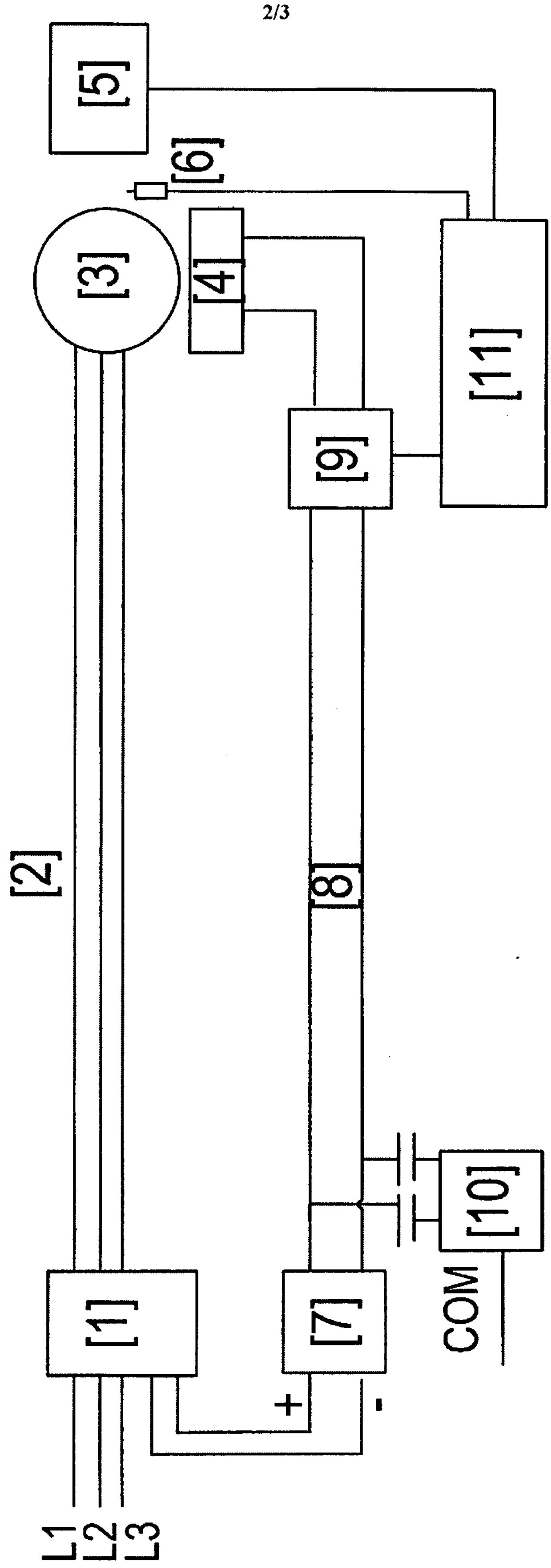


Fig. 2

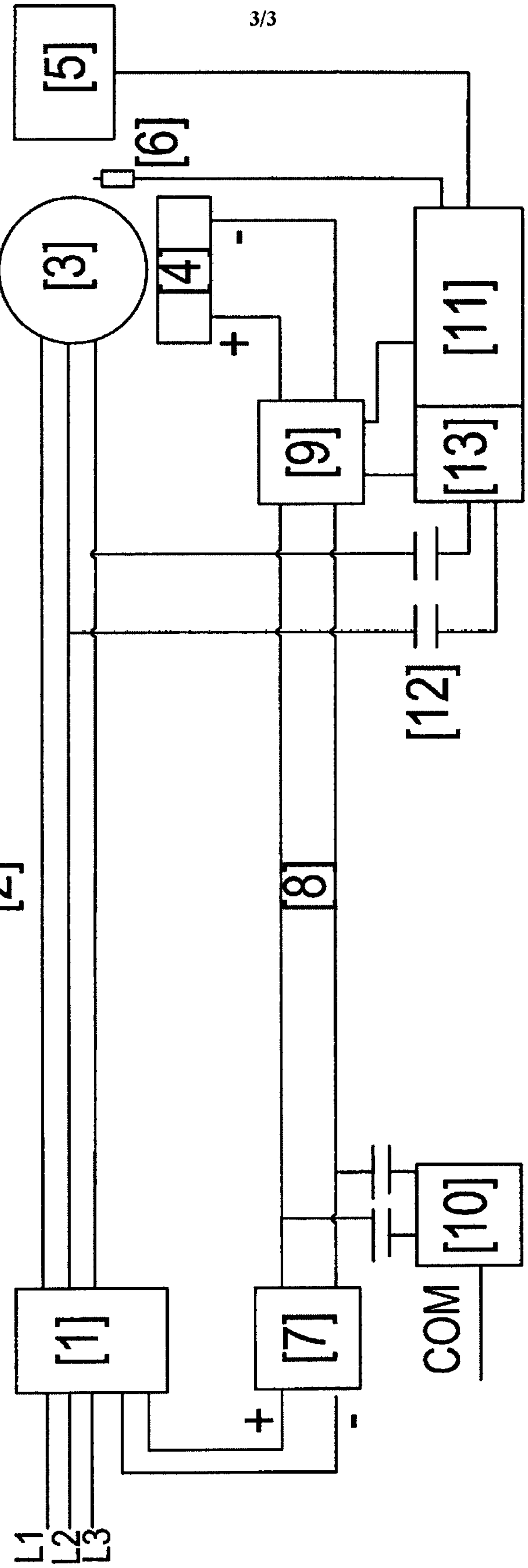
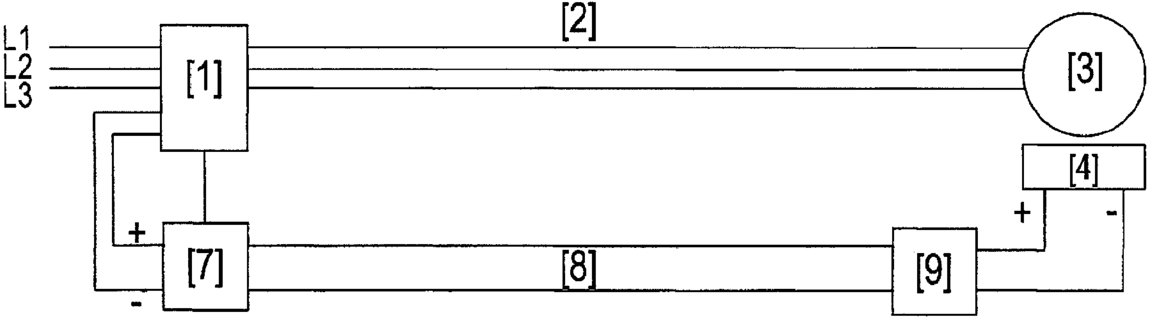


Fig. 3



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