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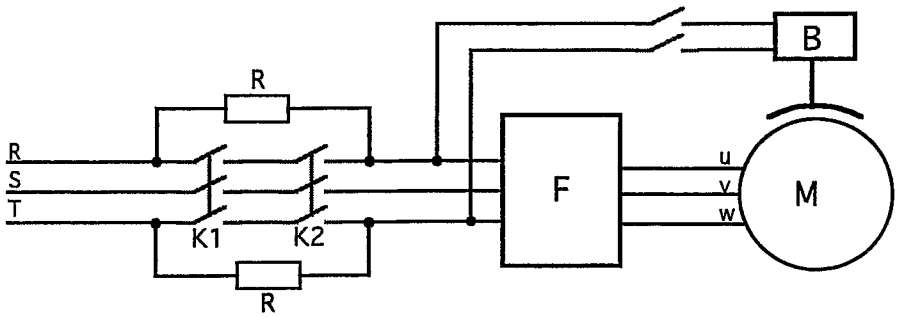
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** CIRCUIT DEVICE FOR A BRAKED MOTOR



(57) **Abstract:** The invention relates to a circuit device for a braked motor (M) forming part of a lifting installation, whereby the circuit device comprises three supply voltage lines (R, S, T), contactors (Kl, K2) arranged in each supply voltage line, at least one frequency converter (F) and three output voltages (u, v, w) connected to the motor (M), whereby the contactors (Kl, K2) are connected in such a way that they can break the voltage to the frequency converter (F). A distinguishing feature of the circuit device according to the present invention is that for at least two of the supply voltage lines (R, S, T) to the frequency converter (F) the contactors (Kl, K2) are bypassed by at least one resistor (R) belonging to each supply voltage line (R, S, T), the resistors (R) taking the form of safety resistances.

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Circuit Device for a Braked Motor

Technical field of the invention

The present invention relates to a circuit device for a braked motor forming part of a lifting installation, whereby the circuit device comprises three supply voltage lines, contactors arranged in each supply voltage line, at least one frequency converter and three output voltages connected to the motor, the contactors being connected in such a way that they can break the voltage to the frequency converter.

Background to the invention

The control of AC motors involves frequency conversion from the supply voltage frequency to the frequencies which are suitable for controlling the motor. The frequency conversion is effected in a frequency converter, and this requires, for safety reasons, circuits with contactors which can disconnect the voltage from the motor. These contactors may break the connection from the frequency converter to the motor or break the connection to the frequency converter directly. The motor's inductance may result in large currents if the voltage from the frequency converter to the motor is broken, which is inappropriate for electronics and may lead to spark formation which causes EMC problems.

The alternative circuit solution in cases where the contactors break the connection to the frequency converter directly entails no disadvantages of large currents, which makes this a preferred circuit solution. The problem with this circuit solution is that when the contactors close

again, the capacitor or capacitors in the frequency converter will have discharged and will take time to recharge. A circuit solution which lacks the disadvantage of the risk of large current pulses when the contactors break the connection, but which at the same time allows a rapid restart, is therefore desirable.

An object of the invention is therefore to provide a circuit device for frequency control which solves the problems of the state of the art in circuit devices for frequency control.

This and other objects are achieved by a circuit device for frequency control according to the characterising parts of the independent claims.

Summary of the invention

The invention relates to a circuit device for frequency control with at least one frequency converter F, contactors K1, K2 and a motor M, where the motor is connected to the output voltages from the frequency converter and where the contactors are connected in such a way that they can break the voltage to the frequency converter F. The advantage of the invention is that for at least two of the input voltages to the frequency converter the contactors K1, K2 are bypassed by at least one resistor, thereby affording the possibility of a rapid restart by capacitors in the frequency converter being kept charged by a weak leakage current through the resistors. To this end, the resistors R take the form of safety resistances in the form of layer-type resistances with painted or coated resistance layers and axial

connections according to applicable IEC standards, or wire resistances with single layer winding protected by enamelling or paint.

Brief description of the drawings

Fig. 1 depicts a first circuit solution according to the state of the art.

Fig. 2 depicts a second circuit solution according to the state of the art.

Fig. 3 depicts an embodiment of the invention.

Description of circuit solutions according to the state of the art

Fig. 1 depicts a first circuit solution according to the state of the art, where the diagram illustrates a frequency converter F, contactors K1 and K2 and a motor M. It also illustrates a brake B, of the type which acts automatically in response to cessation of mains current or cessation of control current. The three supply voltage lines R, S, T are connected to the frequency converter F, which delivers three output voltages u, v and w at a frequency adapted to controlling the motor M. The output voltages u, v and w are connected to the motor M via two sets, connected in series, of contactors K1 and K2 so that each output voltage passes through two contactors. The motor's inductance may result in large currents if the voltage from the frequency converter to the motor M is broken, which is inappropriate for electronics and may lead to spark formation, thereby causing EMC problems. A brake B is also connected to phases R and T.

Fig. 2 depicts another circuit solution according to the state of the art, comprising the same elements as illustrated in Fig. 1, but in this case the output voltages u, v and w from the frequency converter are connected directly to the motor M, and contactors K1 and K2 are situated between the supply voltage and the frequency converter F. Accordingly, when the voltage to the frequency converter is broken, no large currents occur, but the capacitors in the frequency converter will discharge, with the result that when the contactors close again it will take time to recharge the capacitors, thereby rendering this circuit solution slow to restart.

Description of a preferred embodiment

Fig. 3 depicts an embodiment of the invention comprising the same elements as illustrated in Figs. 1 and 2. Accordingly, the circuit solution is identical with that in Fig. 2, which means that the solution has the same advantageous characteristics as the latter except for two significant and advantageous deviations described below. In this context it should be noted that the brake B is of the type which acts automatically in response to cessation of mains current or cessation of control current. The brake B is preferably spring-loaded.

One difference is that for the input voltages R and T the contactors K1 and K2 are bypassed by resistors R which allow a small leakage current to pass to the frequency converter F. This means that at the time of a restart the frequency converter F has charged capacitors and can immediately deliver full current to the motor M. It has the further advantage that EMC problems are reduced in

that current pulses at the time of reconnection will be smaller.

The second difference from the state of the art is that the resistors R take the form of safety resistances in the form of fixed resistances in which short-circuiting cannot occur. More specifically, the resistances take the form of layer-type resistances with painted or coated resistance layers and axial connections according to appropriate IEC standards, or wire resistances with a single-layer winding protected by enamelling or paint. In the present case the expression "safety resistance" is intended to mean such a resistance as defined above in this paragraph.

The dimensioning of the safety resistances R has to be such that the capacitors of the frequency converter will reach about 60-100% of full voltage. The current which the safety resistances R allow to pass will be so small that if the frequency converter is mistakenly activated, the current allowed through will be too small to drive the motor M, which at this stage will be braked.

Conceivable modifications of the invention

As a modification of the circuit device depicted in Fig. 3, it is also possible within the scope of the present invention to conceive of having only one contactor in each supply voltage line R, S, T. As compensation for a contactor failing, the frequency converter F may be provided with a safety arrangement whose function corresponds to that of a contactor.

Claims

1. A circuit device for a braked motor (M) forming part of a lifting installation, whereby the circuit device comprises three supply voltage lines (R, S, T), contactors (K1, K2) arranged in each supply voltage line, at least one frequency converter (F) and three output voltages (u, v, w) connected to the motor (M), whereby the contactors (K1, K2) are connected in such a way that they can break the voltage to the frequency converter (F), c h a r a c t e r i s e d in that for at least two of the supply voltage lines (R, S, T) to the frequency converter (F) the contactors (K1, K2) are bypassed by at least one resistor (R) belonging to each supply voltage line (R, S, T), the resistors (R) taking the form of safety resistances.

2. A circuit device according to claim 1, c h a r a c t e r i s e d in that two contactors (K1, K2) are arranged in each supply voltage line (R, S, T).

3. A circuit device according to claim 1, c h a r a c t e r i s e d in that the motor (M) is a lifting motor.

4. A circuit device according to claim 1 or 2, c h a r a c t e r i s e d in that the brake means belonging to the motor (M) is spring-loaded.

5. A circuit device according to any of the previous claims, c h a r a c t e r i s e d in that the safety resistances are so dimensioned that capacitors forming

part of the frequency converter (F) will reach about 60-100% of full voltage.

Fig 1

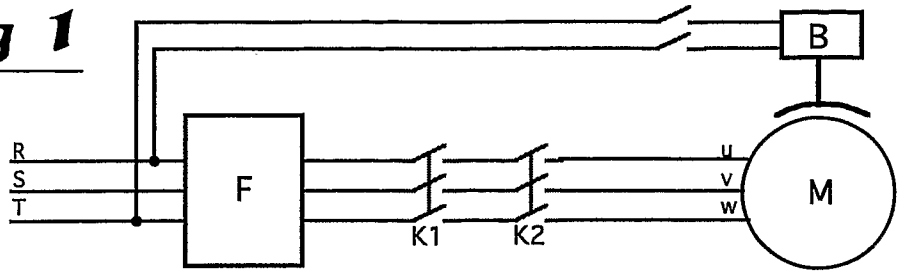


Fig 2

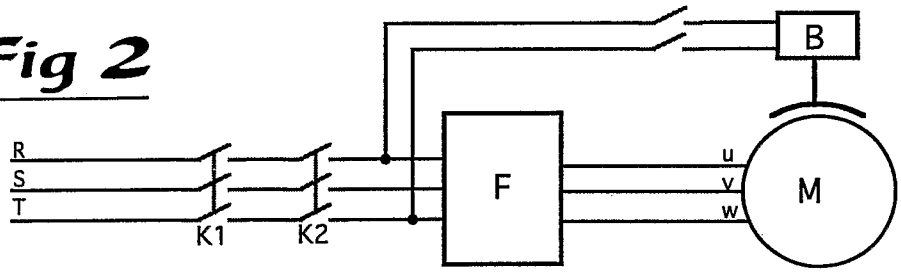
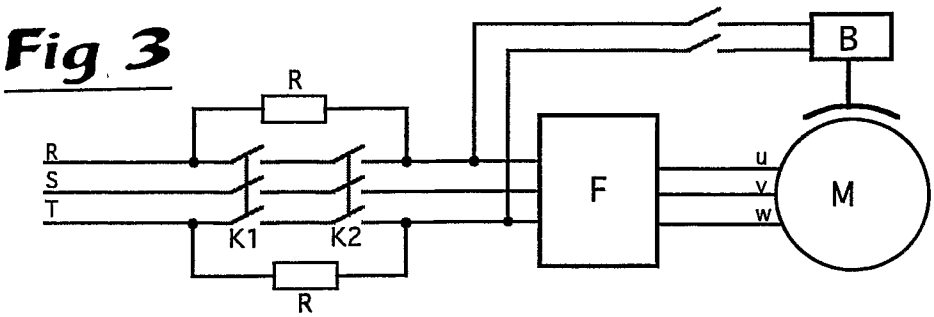


Fig 3



International patent classification (IPC)
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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2007/000524

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B66B, H02H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1520829 A1 (MITSUBISHI DENKI KABUSHIKI) KAISHA), 6 April 2005 (06.04.2005), figure 1 --	1-5
A	GB 1219807 A (HITACHI LTD), 20 January 1971 (20.01.1971), figure 2 --	1-5
A	EP 1067081 A1 (MITSUBISHI DENKI KABUSHIKI KAISHA), 10 January 2001 (10.01.2001), figure 4 --	1-5

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
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