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Datasheet for the decision of 18 July 2011

Case Number: T 0500/08 - 3.5.02

Application Number: 02801259.9

Publication Number: 1436876

IPC: H02J 3/16

Language of the proceedings: EN

Title of invention:
Control system and method for voltage stabilization

Applicant:
Hatch Ltd.

Headword:
-

Relevant legal provisions:
EPC Art. 84

Relevant legal provisions (EPC 1973):
-

Keyword:
"Clarity (yes - after amendment)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0500/08 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 18 July 2011

Appellant: Hatch Ltd.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 12 November 2007 refusing European patent application No. 02801259.9 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: M. Ruggiu
Members: M. Rognoni
P. Mühlens

Summary of Facts and Submissions

I. The appellant (applicant) appealed against the decision of the examining division refusing European patent application No. 02 801 259.9.

II. In the contested decision, the examining division came essentially to the conclusion that claims 1 and 23 were not clear within the meaning of Article 84 EPC.

III. In a communication dated 22 March 2011, the Board expressed the opinion that the features recited in claim 1 according to the appellant's main request, which related to claims identical with the claims considered in the contested decision, clearly defined the subject-matter for which protection was sought. Claim 1 thus satisfied the requirements of Article 84 EPC. On the other hand, the method claim 23 of the main request did not contain some essential features of the invention which were duly recited in the system claim 1. However, claim 23 according to the first auxiliary request filed with the statement of grounds of appeal satisfied the requirements of Article 84 EPC.

IV. In reply to the Board's communication, with a letter dated 9 June 2011, the appellant filed a new main request comprising claims 1 to 29 forming the basis of the first auxiliary request previously on file, and a first auxiliary request comprising claims 1 to 27 forming the basis of the second auxiliary request previously on file. With the same letter, the appellant requested that the present case be remitted to the department of first instance for further prosecution on the basis of the new main request.

V. Claim 1 according to the appellant's main request reads as follows:

"A power control system for reducing voltage flicker in an AC power supply line (10) having a time-varying load (12) connected thereto, characterized in that it comprises:

a first variable inductive reactor (16, 202) intermediate the power supply line (10) and the load (12);

a second variable reactor (200, 206) connected in parallel with the power supply line (10); and

a control system for

(i) monitoring load current and adjusting the first variable inductive reactor (16, 202) in response to changes in the monitored load current to reduce voltage flicker; and

(ii) monitoring reactive power draw from the AC power supply line (10) and adjusting the second variable reactor (200, 206) in response to changes in the monitored reactive power to reduce voltage flicker."

Claims 2 to 22 are dependent on claim 1.

Claim 23 reads as follows:

"A method for controlling voltage flicker in an AC power supply line (10) having a time-varying load (12) connected thereto, characterized by the steps of:

(a) providing a variable inductive series reactor (16, 202) intermediate the power supply line (10) and the load (12);

(b) providing a variable parallel reactor (200, 206) in parallel with the power supply line (10);

(c) monitoring load current and varying an inductance of the variable inductive series reactor (16, 202) in response to changes in the monitored load current to reduce voltage flicker; and

(d) monitoring reactive power draw from the AC power supply line (10) and varying a reactance of the variable parallel reactor (200, 206) in response to changes in the monitored reactive power draw to reduce voltage flicker."

Claim 24 to 29 are dependent on claim 23.

The claims according to the first auxiliary request are not relevant to the present decision.

Reasons for the decision

1. The appeal is admissible.

2. In the contested decision, the examining division considered the wording used in claim 1 as vague, indefinite and only conveying in functional terms the result to be obtained (*i.e. "to reduce voltage flicker"*) without defining the means necessary for achieving this result. Merely stating that the reactors were *"adjusted in response to changes in current/reactive power"* did not provide a clear definition of the measures to be taken to achieve the desired result. In fact, the type of adjustment was in no way defined and the skilled man would have to look for necessary solutions: such as to increase or decrease the reactance by a definite amount

in a definite manner in incremental or fixed values etc.. Also the type of change in the current/reactive power to affect the adjustment was not defined, as claim 1 covered any increase or decrease in current/reactive power by an undefined amount in an undefined manner in unknown incremental or fixed values, etc..

3.1 According to the application as published (page 1, second paragraph) time *"varying loads can result in unwanted voltage fluctuations in a power supply network. An example of such a load are alternating current (AC) electric arc furnaces, which are commonly used to melt and remelt ferrous materials such as steel, and to smelt non-ferrous materials. Such furnaces generally use high power arcs to generate heat energy in a refractory lined vessel, and include a power supply for controlling the electrical energy supplied to the arc. High power arcs are an energy conversion mechanism that behave as a non-linear time-varying impedance. Consequently, the voltage, current and power drawn by an arc furnace tends* [sic] *to fluctuate, causing disturbances to both the melting process and to the supply network. These disturbances can result in inefficiencies, increased equipment wear, disturbances to the power network, and in extreme cases damage to the supply network or arc furnace. The voltage disturbances that occur in the supply network arising from large and rapid fluctuations in the load current and power factor during certain operating stages of the furnace are often referred to as "flicker". Furnace flicker is a common problem for both furnace operators and power distributers. Power distributers will often place strict limits on flicker caused by furnaces that*

draw power from their distribution systems in order to reduce disturbances to such distribution systems" (emphasis added).

3.2 It is furthermore acknowledged on page 1, third paragraph, to page 2, first paragraph, that various technologies have been developed for power control and flicker reduction for arc furnaces. One technology is the static VAR compensator (SVC). *"An SVC consists of a shunt connected harmonic filter bank and a shunt connected thyristor- controlled reactor, which operate in concert to lower voltage flicker or maintain a constant furnace power factor. The SVC operates by shunt injection of either capacitive or inductive reactive power, thereby maintaining a constant voltage by maintaining the total reactive power draw (MVAR) of the furnace balanced near zero (ie. neither inductive or capacitive). SVC's typically have a half cycle time delay due to thyristor commutation requirements. An example of an early SVC can be seen in U. S. Patent No. 3,936,727.*

SVC based arc furnace controllers dynamically supply reactive power by the controlled summation of constant capacitive MVAR and variable inductive MVAR. The controller compares load reactive power to a set point power factor and dynamically controls the summated MVAR to the set point. As an electric arc furnace frequently short circuits and open circuits on bore in of the furnace electrodes, the furnace reactive power swings vary from zero to 200% of the furnace transformer rating. An SVC is normally sized at 125% to 150% of the furnace rating and typically reduces flicker by approximately 40% to 50%. Some SVCs use a voltage set point, and adjust a shunt reactor to match

a process voltage to the set-point voltage" (emphasis added).

3.3 In other words, the present application points out that in known power control systems the shunt reactor is adjusted so as to inject either capacitive or inductive power and thus balance near zero the total reactive power draw (MVAR) of the furnace.

3.4 Another known flicker reduction technology is the smart predictive line controller (SPLC) (see page 2, third full paragraph) *"that consists of a thyristor connected in series with the arc electrode and a harmonic filter bank. An SPLC functions as a dynamically controlled series reactor that uses predictive software to stabilize the current on an electric arc furnace. The SPLC reduces flicker by lowering arc current fluctuations on the power systems. When arc current fluctuations are flat lined, the voltage flicker is reduced. An example of an SPLC can be seen in U. S. Patent No. 5,991,327 issued November 23, 1999"* (emphasis added).

3.5 In the light of the state of the art cited in the present application, it was known to the skilled person that voltage flicker in an AC power supply could be controlled either by a variable reactor (*i.e. "a first variable inductive reactor"* according to claim 1) intermediate the power supply and the load or by a variable reactor (*i.e. "a second variable reactor"*) connected in parallel with the power supply. It was furthermore known to adjust the former so as to stabilize the current drawn by the arc, while adjustments of the latter aimed at reducing the

reactive power swings. Thus, the adjustments of the series and parallel reactors were directed to reducing variations in the load current and in the reactive power draw, respectively.

3.6 Relying on this background knowledge in the field of power control system, the skilled person would know how adjust the first variable inductive reactor and the second reactor in order to achieve the results specified in claim 1.

In fact, the gist of the present invention consists essentially in using variable shunt and series connected reactors in a complementary combination to provide flicker and power control for a time-varying load such as an arc furnace. A detailed embodiment of the invention is described in the application.

3.7 In summary, the Board finds that, in the context of the application as originally filed, the features recited in claim 1 of the appellant's main request clearly define the subject-matter for which protection is sought and thus satisfy the requirements of Article 84.

4. Claim 23 according to the main request relates to a method for controlling voltage flicker in an AC power supply line. Its steps correspond essentially to the functions performed by the features recited in the system claim 1. In the Board's opinion claim 23 also satisfies the requirements of Article 84 EPC.

5. In the result, the Board decides to set aside the decision under appeal and to remit the case to the

department of first instance for further prosecution in accordance with the appellant's main request.

Order

For the above reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance for further prosecution.

The Registrar: The Chairman:

C. Moser M. Ruggiu