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File Number: T 942/90 - 3.5.1

Application No.: 81 304 252.0

Publication No.: 0 049 578

Title of invention: Steam Turbine-generator control system

Classification: F01D 17/24

D E C I S I O N
of 3 December 1991

Proprietor of the patent: WESTINGHOUSE ELECTRIC CORPORATION

Opponent: Siemens Aktiengesellschaft, Berlin und München

Headword:

EPC 52(1), 54, 56

Keyword: "novelty" (yes) -
"inventive step" (no)

Headnote



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Boards of Appeal

Chambres de recours

Case Number : T 942/90 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 3 December 1991

Appellant :
(Proprietor of the patent)

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Respondent :
(Opponent)

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Decision under appeal :

Decision of Opposition Division of the European
Patent Office dated 12.10.1990 rejecting the
opposition filed against European patent
No. 0 049 578 pursuant to Article 102(2) EPC.

Composition of the Board :

Chairman : P.K.J. van den Berg
Members : C.G.F. Biggio
F. Benussi

Summary of Facts and Submissions

- I. European patent EP-B1-0 049 578 was granted on European patent application No. 81 304 252.0, filed at the EPO on 16 September 1981, claiming its rights of priority from the patent application No. US 191 606, filed in the United States of America on 29 September 1980, and published on 14 April 1982.

The notice of said grant was made available to the public on 8 June 1988.

On 8 March 1989 an opposition was filed, requesting that the European patent be revoked in its entirety.

- II. By its decision dated 12 October 1990, the Opposition Division revoked the patent.

The ground given for the decision was that the subject-matter of Claims 1 to 7, as granted, lacked an inventive step pursuant to Article 56 EPC.

- III. In its decision, the Opposition Division referred to the following citations:

D1 = DE-A-1 426 802,

D2 = Leaflet of MOOG GmbH: "Durchfluß - Servoventile Baureihe 73, Katalog 730, Nr. 730.5.75,

D3 = POWER, May 1977, Pages 25 to 32, "Understanding Microprocessors", by T.C. Elliott,

D4 = VGB Kraftwerkstechnik 56, Heft 4, April 1976, pages 241 to 246, "Ein Programmsystem zur Automatisierung der Leitebene eines Turbosatzes im Kraftwerk Westfalen der VEW", by Hösch,

D5 = Regelungstechnische Praxis, Vol. 22, Nr. 3, 1980, "Eine fehlertolerierende Reglerstation auf der Basis

eines busorientierten Multi-Mikrorechner-Systems", by
W. Sandler,

D6 = Paper IAEA-SM226/100, by G. Yan et al,

D7 = Paper 71457 of 24th NJ-NY ISA Symposium, May 1971, by
L.B. Podolsky et al, and

D8 = US-A-4 035 624

- IV. On 10 December 1990, the Patentee lodged an appeal against said decision and paid the appropriate fee.

On 7 February 1991, the Appellant filed his Statement of Grounds submitting, as main request, that the appealed decision be reversed and that the patent be maintained as granted.

Subsidiarily he requested to be heard at oral proceedings, in the event that his main request would not be granted.

- V. In his Grounds for Appeal, the Appellant submitted that the Opposition Division was wrong in contending that the subject-matter of Claim 1 lacked an inventive step in respect of the considered citations, whose disclosures, in his opinion, do not support such a conclusion.

- VI. On 19 June 1991, the Respondent filed his observations on the Appellant's Grounds for Appeal.

He strongly disputed the Appellant's argumentation and filed a further supporting document:

D9 = "abc's of computers", by Allan Lytel, 2nd Edition, 3rd Reprint, 1969, edited by Howard W. Sams & Co., Inc., Indianapolis (Library of the Congress Catalogue Card Number 66-19 678).

He requested that the appeal be rejected, and that the Board confirm the revocation decision by the Opposition Division.

VII. On 22 August 1991, the Appellant filed further comments on the Respondent's observations.

He disputed that the teaching of the newly mentioned document D9 might render obvious the subject-matter of Claim 1 as granted.

VIII. On 28 October 1991, in a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, the Rapporteur set out the preliminary view of the Board. It was stated that the subject-matter of Claim 1 followed in an obvious manner from D8, which was regarded as the closest prior art document on file, in conjunction with D5.

IX. According to the Appellant's auxiliary request, oral proceedings were held on 3 December 1991.

The Appellant contended that the main teaching of D5 was to provide hardware redundancy in order to increase the reliability of the system. This, however, was not the goal of the invention as specified in Claim 1 of the contested patent.

Its aim was instead to control individually each valve of the turbine, the controls being co-ordinated by a central computer.

The Respondent submitted that he basically agreed with the arguments set out in the aforementioned communication of the Board.

X. Claim 1 as granted reads:

"A control system for a steam turbine (10) operative to drive an electric generator (30) and having a plurality of steam admission valves (TV, GV) which are controllable in position to determine the operating level of the turbine, comprising a controller (70) including memory means for storing digital information including data and operation instructions, digital processing circuitry (100) to process said digital information and means (106, 107, 109, 110, 120, 150) for inputting and outputting information; each said steam admission valve being associated with a valve actuation circuit (154, 156) operable, in response to a control signal, to position the valve so as to control its degree of opening; position detecting means (160) coupled to each said valve to provide respective feedback signals (164) indicative of valve position; a plurality of valve position control circuits (74) each operable to provide an output valve position control signal (158) to a respective one of said valve actuation circuits, characterized in that each valve position control circuit includes input means (172, 194) for receiving digital information signals from said controller as well as a respective one of said feedback signals, memory means (233, 234) for storing digital information including data and operating instructions, digital processing circuitry (230) for processing said digital information, including that received from said controller (70), for deriving said valve position control signal and output means (174) for transmitting digital information back to said controller (70)".

XI. The Appellant requested that the decision under appeal be set aside and the patent be maintained as granted.

XII. The Respondent requested that the appeal be dismissed.

Grounds for the decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.
2. Since no amended claims have been filed, Article 123 (2 & 3) EPC need not to be considered.
3. The only issue to decide is whether or not the patent complies with Articles 52 to 57 EPC.

4. Novelty

In the Board's opinion, D8 represents the closest prior art on file.

With reference to its fig. 1 and 2, this document discloses the features contained in the precharacterising clause of Claim 1, namely:

- a control system (1100) for a steam turbine (10) operative to drive an electric generator (16) and having a plurality of steam admission valves (TV, GV) which are controllable in position to determine the operating level of the turbine, comprising
- a controller (210) including memory means (212) for storing digital information including data and operation instructions, digital processing circuitry (212) to process said digital information and means (166) for inputting (see: Col. 7, lines 40 to 59) as well as means (224) for outputting (see: Col. 8, lines 27 to 30) information;
- each said steam admission valve being associated with a valve actuation circuit (42, 44) operable, in response to a control signal, to position the valve so as to control its degree of opening;

- position detection means (PD) coupled to each said valve to provide respective feedback signals indicative of valve position;
- a plurality of valve position control circuits (Fig. 3A) each operable to provide an output valve position control signal to a respective one of said valve actuation circuits.

The communication between the central processor and the valve actuation circuits is effected using analog signals, as indicated in Fig. 3A, input 520.

The system described in D8 thus appears to be of the centralised kind referred to in Col. 1, lines 14 to 25, of the patent at issue.

D8 however does not disclose the features mentioned in the characterising clause of Claim 1.

Since no other prior art document on file comes closer to the claimed invention than D8, the subject-matter of Claim 1 must be regarded as novel.

5. Inventive step

From D5 it is known that the reliability of a digital control system may be improved by using distributed control ("dezentrale Gestaltung eines Prozeßregelungs-systems") instead of centralised control.

According to the statement: "Bei einigen neueren Prozeßregelungssystemen können die Unterstationen neben Regelaufgaben auch Steueraufgaben und andere Automatisierungsfunktionen übernehmen" (see: page 74, end of paragraph 1.2), substations, provided with microcomputers and located near the controlled units, may

take over servo and control tasks previously performed by the central processor.

In Table 1, on page 79, and paragraph 7.1, on pages 78 to 79, examples of tasks which may be performed by the substations ("Funktionsrechner") are given. Inter alia, the following possibilities are specified:

- servo control function using D/A and A/D converters (INPUT, OUTPUT),
- computing function for PID-algorithms and other automatisisation functions (DDC), and
- communication function (MELDUNG) with the main computer ("Konfigurationsrechner").

According to a typical controller structure, shown in Fig. 4, the substations ("Funktionsrechner") are connected via a bus to the main computer ("Konfigurationsrechner").

D5 thus discloses the general technical concept associated with the characterising features of Claim 1.

6. The skilled man in the present case is a servo and control engineer specialised in turbine control. He is familiar with general developments in the field as well as with particular turbine control systems.

The background art according to D5 would hence be known to him.

It is the constant endeavour of any skilled man to improve on existing systems in accordance with recent general technical concepts. Therefore, the mere idea of incorporating the distributed processor system proposed in D5 into the turbine control system known from D8 cannot be regarded as implying an inventive step.

The combined system itself, as specified in Claim 1, was also obvious unless the skilled man would have hesitated to implement this idea, either because of a technical prejudice to be overcome, or because of difficulties encountered in the process of combination, difficulties which would have required inventive skill.

The Board is satisfied that no such obstacles existed.

The various control principles employed earlier (see for example the introduction of D7) indicate that the interest in new techniques has previously been vivid in the field of turbine control. This renders the idea of a technical prejudice improbable.

Moreover, the adoption, as reflected by Claim 1, of the prior art turbine control to the principles set out in D5 appears to have been straight forward.

D5 directly implies most of the features of the characterising part of Claim 1 since, practically by definition, the substations described in D5 must comprise input means for receiving digital data from the controller, memory means, and digital processing means; also output means would be necessary for sending output control values to the actuators and messages to the main computer. In fact, the only characterising feature in Claim 1 which was not directly derivable from D5 is the recognition that it is the valve position control circuit - and not some other part of the turbine control - which should be designed as substation.

According to D8, the admission valves constitute the primary means for regulating the shaft speed, and the shaft speed in its turn is known to be "the single most

important variable" of the turbine in operation (see: Col. 1, lines 32 to 44).

It appears hence self-evident that, if a new control principle is chosen, at least the most essential variable of the whole system should be controlled according to it.

The Board therefore concludes that the skilled man, on reading D5, would indeed have been led to provide substations to control the rather complex feedback loops regulating the position of these valves.

8. The Appellant's argument that D5 is mostly concerned with hardware redundancy does not alter the fact that the concept of decentralised control disclosed therein was in itself a sufficient incentive to modify the turbine control of D8.

The advantages offered by redundant units are in D5 presented in addition to and independently of this concept.

The situation is in fact similar to the one in the contested patent, which proposes corresponding redundancy measures in the dependent Claims 3 and 5 in addition to the processing circuitry of Claim 1.

9. Thus, the subject-matter of Claim 1 does not involve an inventive step within the meaning of Article 56 EPC and is therefore not patentable pursuant to Article 52(1) EPC.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar:

M. Kiehl

The Chairman:

P.K.J. van den Berg