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Bezeichnung der Erfindung: Electromagnetic feeder drive control apparatus
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : G01G 13/24

ENTSCHEIDUNG / DECISION
vom / of / du 7 November 1990

Anmelder / Applicant / Demandeur : Kabushiki Kaisha Ishida Koki Seisakusho

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56 EPC

Schlagwort / Keyword / Mot clé : "Main and auxiliary requests: Inventive step (no)"

Leitsatz / Headnote / Sommaire

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Case Number : T 473/90 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 7 November 1990

Appellant : Kabushiki Kaisha Ishida Koki Seisakusho
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Decision under appeal : Decision of Examining Division 036 of the European Patent Office dated 18 January 1990 refusing European patent application No. 84 306 219.1 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : E. Turrini
Members : M. Chomentowski
C.R. Payraudeau

Summary of Facts and Submissions

I. European patent application No. 0 139 463 (84 306 219.1) was refused by the decision of the Examining division.

II. The reason for the refusal was that the subject-matter of the claims lacked an inventive step with regard to
D1 = Aufbereitungs-Technik, No. 8, 1976, pages 381-385 (H.W. Höckel), and
D2 = EDN Magazine, June 1981, pages 192 and 196 (J.R. Bryttan)

III. The Appellant lodged an appeal against this decision.

IV. In the annex to the invitation for oral proceedings, auxiliarily requested by the Appellant, the Board of appeal expressed its provisional opinion that the subject-matter of the claims of the main request, which were the claims rejected in the contested decision, and the claims of the auxiliary request filed with the statement of grounds for the appeal were considered as lacking an inventive step with regard to the same two documents D1 and D2.

V. Oral proceedings were held before the Board, at the end of which the Appellant requested that the appealed decision be set aside and that the patent be granted on the basis of the patent documents of a main request or of an auxiliary request. Claim 1 of the main request reads as follows:

"1. Combinatorial weighing apparatus including a plurality of weighing machines and electromagnetic vibratory feeders (2, 22) for supplying articles to be weighed to the weighing machines, control circuitry being provided for

connecting each said feeder to an AC power supply (1), which circuitry comprises:

first and second electrical supply lines for connection to respective output terminals of such a power supply (1); switching elements (3, 30) connected in series with respective feeders (2), between the said first and second supply lines, and each having an input for receiving a trigger pulse for switching the element into a conductive state; and
switching drive circuitry (4, 11 to 14) connected for delivering successions of trigger pulses to the inputs of the switching elements when the apparatus is in use, thereby to permit successive pulses of driving current to pass through the series-connected feeders, and controllable selectively so as to vary the timing of each such trigger pulse in relation to the phase of the AC power supply (1) thereby to vary the vibratory amplitudes of the feeders; wherein the switching drive circuitry (4, 11 to 14) includes a microprocessor (4) operable to bring about such delivery of such trigger pulses at instants which are delayed by selectively variable time intervals, measured out by a counting operation of the microprocessor, after zero-crossing instants of the AC power supply voltage when the circuitry is in use, which zero-crossing instants are detected by a zero-crossing sensor (11) of the switching drive circuitry (4, 11 to 14), and wherein the switching drive circuitry further includes adjustment means (402) whereby desired periods of actuation of the said feeders, over which periods the successions of trigger pulses are to be continued, can be selectively preset." Claim 1 of the main request is accompanied by dependent Claims 2-6. Claim 1 of the auxiliary request reads as follows:

"1. Combinatorial weighing apparatus including a plurality of weighing machines and electromagnetic vibratory feeders (2, 22) for supplying articles to be weighed to the weighing machines, control circuitry being provided for connecting the feeders to an AC power supply (1), which circuitry comprises:

first and second electrical supply lines for connection to respective output terminals of such a power supply (1);
switching elements (3, 30) connected in series with respective feeders (2), between the said first and second supply lines, and each having an input for receiving a trigger pulse for switching the element into a conductive state; and
switching drive circuitry (4, 11 to 14) connected for delivering successions of trigger pulses to the inputs of the switching elements when the apparatus is in use, thereby to permit successive pulses of driving current to pass through the series-connected feeders, and
controllable selectively so as to vary the timing of each such trigger pulse in relation to the phase of the AC power supply (1) thereby to vary the vibratory amplitudes of the feeders; wherein the switching drive circuitry (4, 11 to 14) includes:
a microprocessor (4) operable to bring about such delivery of such trigger pulses at instants which are delayed by selectively variable time intervals, measured out by a counting operation of the microprocessor, after zero-crossing instants of the AC power supply voltage when the circuitry is in use, which zero-crossing instants are detected by a zero-crossing sensor (11) of the switching drive circuitry (4, 11 to 14), adjustment means (402) whereby desired periods of actuation of the said feeders, over which periods the successions of trigger pulses are to be continued, can be selectively preset, a

photocoupler (12) connected between the said microprocessor (4) and the zero-crossing sensor (11), and trigger pulse transfer circuits (14), connected between the said microprocessor (4) and the said inputs of the switching elements (3, 30), each comprising a light-emitting diode, connected to receive such trigger pulses, and a photo-thyristor, arranged to receive light emitted by the said diode upon receipt of such a trigger pulse." Claim 1 (auxiliary request) is accompanied by dependent Claims 2-4.

VI. In support of the allowability of his requests, the Appellant submitted essentially the following arguments. The prior art shown in the present application and illustrated by Fig.1 is "in-house" prior art. Starting from this prior art including an electromagnetic vibratory feeder connected to an AC power supply through a SCR (thyristor), the invention solves the problems mentioned on original pages 2 and 3 that, since the SCR trigger pulse command signal from the drive control circuit is applied to the gate electrode of the SCR after a delay determined by a CR time circuit, said phase control cannot be carried out while the CR time constant circuit is being charged, that moreover, owing to variation in the characteristics of the CR elements, there are cases where correct phase control of the trigger pulse cannot be performed and that, additionally, the circuit construction is complex. Moreover, the Applicant has identified a further problem, which concerns the accuracy of the feeding operation of combinatorial weighing systems, which are used for weighing and packing articles, for instance in supermarkets. This further problem is solved by the invention by determining by a testing operation at the beginning of the operation of the apparatus, the reference weight of the articles to be fed by each feeder, the value of the phase of the AC power supply necessary for

controlling the amplitude of vibration of each of the feeders and the duration of each feeding operation. The invention uses a zero-crossing detector and microprocessors for counting operations for determining the phase from zero-crossing for controlling the vibration amplitude of each feeder, and for presetting the desired period of actuation of each feeder. This results in an adequate control, by the microprocessors, of the weight to be delivered by each feeder to the corresponding weighing apparatus, and there is no need for any feedback from the weighing apparatus to the corresponding feeder.

D1 is not concerned with combinatorial weighing. The person skilled in the art of D1 would not detect any problem in the analogically controlled apparatus or systems disclosed in D1 and, therefore, would see no incentive for using the digital technique of D2. Even if he did combine the teachings of D1 and D2, the result would not be combinatorial weighing and, moreover, the feature of the adjustment means for selectively presetting the desired periods of actuation would not be included. Therefore, this would not result in the subject-matter of Claim 1 of the main request.

Reasons for the Decision

1. The appeal is admissible.

2. Main request

2.1 Novelty

2.1.1 The Board is of the opinion that the closest document of the available prior art is D1 (see in particular Fig.5 and the corresponding text, for the basic circuit diagram of a voltage-controlled connector set for a feeder (1)), which

discloses an apparatus including an electromagnetic vibratory feeder (1) for supplying articles, control circuitry being provided for connecting the feeder to an AC power supply (UE), which circuitry comprises:
first and second electrical supply lines for connection to respective output terminals of such a power supply;
a switching element (2) connected in series with the said feeder (1), between the said first and second supply lines, and having an input for receiving a trigger pulse for switching the element into a conductive state; and
switching drive circuitry (3, 4, 6, 7, 8, 9) connected for delivering successive trigger pulses to the input when the apparatus is in use, thereby to permit successive pulses of driving current to pass through the said feeder, and controllable selectively so as to vary the vibratory amplitude of the said feeder.

2.1.2 The subject-matter of claim 1 differs from the apparatus known from D1 in that:

(a) the claimed apparatus is a combinational weighing apparatus including a plurality of weighing machines for weighing the articles provided by the corresponding electromagnetic vibratory feeder;

(b) the switching drive circuitry of the claimed apparatus is controllable selectively so as to vary the timing of each trigger pulse in relation to the phase of the AC power supply and includes a microprocessor operable to bring about such delivery of such a trigger pulse at an instant which is delayed by a selectively variable time interval, measured out by a counting operation of the microprocessor, after a zero-crossing instant of the AC power supply voltage when the circuitry is in use, which zero-crossing instant is detected by a zero-

crossing sensor of the switching drive circuitry, and

(c) said switching drive circuitry further includes adjustment means whereby desired periods of actuation of each of the feeders, over which period the succession of trigger pulses is to be continued, can be selectively preset.

2.1.3 Since the other available prior art documents only relate to isolated features of Claim 1 such as electronic control elements, weighing machines or feeding machines, they are considered as less relevant.

2.1.4 Therefore, the subject-matter of Claim 1 is novel (Art.54(2) EPC).

2.2 Inventive step

2.2.1 D1 belongs to the technical field of apparatus including an electronically controlled electromagnetic vibratory feeder for supplying articles (see in particular D1, Fig.5 and Fig.8). Since an important part of this document concerns the electronic means for controlling the said apparatus, the person skilled in the art of D1 is also skilled in the art of electronic controlling of apparatus or systems.

2.2.2 A problem of the prior art apparatus of Fig.5 of D1, wherein an electromagnetic vibratory feeder is used for supplying articles to a weighing machine, is the possible lack of accuracy of the feeding. This problem becomes more acute when a plurality of electromagnetic vibratory feeders are combined for supplying articles to corresponding weighing machines, in an apparatus such as illustrated by Fig. 8 of the same D1.

2.2.3 The apparatus of Claim 1 intends to solve this problem.

2.2.4 Concerning the first distinguishing feature (a), it is to be noted that combinatorial weighing is a generally known technique and is substantially defined as a system operating by supplying a plurality of weighing machines with articles to be weighed, weighing the articles supplied to each machine, applying a signal indicative of the weight of the articles in each weighing machine to a computation control unit, having the computation control unit performing a combinatorial computation based on a predetermined pattern, selecting a combination which satisfies prescribed conditions, and discharging the articles from the weighing machine corresponding to the selected combination; an electromagnetic vibratory feeder is used for supplying articles to a weighing machine(see the statements of page 1 - page 3, line 10 of the description). Claim 1 is concerned substantially with a plurality of electromagnetic vibratory feeders for supplying articles to a weighing machine, with a controlling unit for controlling said feeding. The other features of the combinatorial weighing apparatus are not mentioned in Claim 1 and, in the opinion of the Board, are not essential features of the invention.

2.2.4.1 Although D1 does not deal explicitly with a combinatorial weighing apparatus, it already discloses an electromagnetic vibrator feeder apparatus used in combination with a weighing device, the feeding being controlled by electronic means (see D1, the paragraph "Waageaufschaltung-Bandwaagenregelung-Dosierbandwaagen", page 382, column 2 - page 383, column 1, with Fig. 6 and 7); the disclosed combined means, i.e. a weighing machine and an electromagnetic vibrator feeder for supplying articles to be weighed to the weighing machine, with the

electronic control means, constitute an important part of a combinatorial weighing apparatus. Moreover, D1 also discloses systems with a plurality of feeders each associated with a weighing machine (see D1, Fig.10 and the paragraph "Verfahrensbeispiel aus der Zementindustrie", page 385).

2.2.4.2 Therefore, the Board is of the opinion that, since the person skilled in the art of D1 is concerned with systems comprising feeders associated with weighing machines and controlled by electronic means, he should be aware that there are combinatorial weighing systems and that they use said same parts.

2.2.5 Concerning the second distinguishing feature (b), it is to be noted that a switching drive circuitry controllable selectively so as to vary the timing of each trigger pulse in relation to the phase of an AC power supply including a microprocessor operable to bring about delivery of a trigger pulse at an instant which is delayed by a selectively variable time interval, measured out by a counting operation of the microprocessor, after a zero-crossing instant of the AC power supply voltage when the circuitry is in use, which zero-crossing instant is detected by a zero-crossing sensor of the switching drive circuitry, is known from D2 (see the Figure and accompanying text).

2.2.5.1 D2 belongs to the technical field of the direct controlling of Triac's firing phase angle, for controlling electrical values (such as a lamp's intensity or a motor's speed). Indeed, it is generally known to the person skilled in the art of D2, as well as to the person skilled in the art of D1, that Triac and thyristor are examples of a switching device (see for instance D1, Fig. 3, for a triac, as compared with Fig. 5, for a

thyristor). Moreover, as mentioned in paragraph 2.2.1 above, the person skilled in the particular art of D1 of controlling apparatus including an electromagnetic vibratory feeder for supplying articles, will also be aware of the technical field of D2 of the direct controlling of a switching device's firing phase angle, for controlling electrical values, because he needs this teaching for the control of the amplitude of vibration of the feeder.

2.2.5.2 The Board is of the opinion that the switching drive circuitry of D2 and the switching drive circuitry of D1 are equivalent controlling devices because they have the same controlling function. Therefore, the device of D2, which is known to the person skilled in the art of D1, can be substituted for the device of D1 in an obvious way.

2.2.6 Concerning the third distinguishing feature (c), it is to be noted that Claim 1 does not provide any specific information about the mentioned adjustment means whereby a desired period of actuation of the feeder is selectively preset. The term "selectively preset" does not specify whether said "desired period of actuation" is selectively preset for reasons which are related to the apparatus and its function, or for reasons, unrelated to the apparatus and its function, but which can be related to other facts such as the duration of the working day, for instance. Therefore, any of the numerous devices generally known to people skilled in the art, such as for instance an alarm-clock in combination with a switching circuitry, can provide the desired period of actuation. Moreover, even by taking into account the content of the present application, and in particular the program flow chart of Fig. 3 and the time charts of Fig. 6 and 7 illustrating the operation of the apparatus of Fig. 4,

which show that the adjustment means are associated with the other elements of the circuitry controlling the amplitude of vibration of the feeders for determining the quantity of articles to be delivered, it is to be noted that the adjustment means act in their normal and usual way and that no unexpected effect results from the juxtaposition of the adjustment means with the other means known from D1 and D2.

2.2.7 Therefore, the Board is of the opinion that, starting from the teaching of D1 concerning the use of electronically controlled electromagnetic vibrator feeders, in particular in association with weighing elements, and more in particular for a plurality of them, the person skilled in the art would be aware of the possible use of this teaching of D1 in the closely related field of combinatorial weighing systems; he would also be aware that the electronic control means of D2 are equivalent to the analogical electronic control means of D1 and could be substituted for them in an obvious way; he would also be aware that he could juxtapose adjustment means whereby a desired period of actuation of the feeder is selectively preset, since such means are generally known to people skilled in the art and can be used for many purposes whereby a desired period of actuation of the feeder is selectively preset. Moreover, since all elements act according to their known properties and no unexpected effect results from the combination of these steps, they do not contribute to an inventive step.

2.3 The arguments of the Appellant that the person skilled in the art of D1 would not consider a device of the type disclosed in D2, and that he would anyway find no incitation to use it in the context of D1, are not considered as relevant because, as mentioned above, the skilled person of D1 would also be aware of the

possibilities offered by other switching drive circuitry devices, which may be necessary for his activity in the field of D1, and because the person skilled in the art, presented with a new available technical means, does not need any incentive for substituting it for an older means if they are both technically equivalent, and he would not exercise any inventive activity by doing so.

2.4 The Appellant has provided arguments concerning the particular problem of feeding accuracy for the quantity of material to be delivered, which is a concern of the present invention, but should not be a concern for D1, which is mainly concerned with the rate of supply and which controls the said rate only by controlling the vibratory amplitude. However, these arguments are not considered as relevant because it is generally known to people skilled in the art that the quantity of articles to be delivered by an electromagnetic vibrator feeder depends on the amplitude of the vibrations of the feeder and on the duration of said feeding; Claim 1 does not provide any specific information concerning the means which combine or associate the feeding means and the timer so that feeding accuracy of the quantity of articles is increased. Therefore, the apparatus of Claim 1 can only be considered as a juxtaposition of means acting in their normal way without resulting unexpected effect.

2.5 The Appellant has argued that the invention would provide the unexpected effect that the feeder and the timer of the apparatus of Claim 1, once initially tested for a particular kind of articles, operate by using counting operation controlled by microprocessors, resulting in an apparatus which is accurate and does not need any feedback from the weighing elements to the feeders during the operation. However, the description states that, in cases where the quantity of articles during a single cycle of

operation begins to show a tendency toward ever larger values with respect to a reference quantity, the amount of feeder operation is reduced, thereby reducing the quantity of articles supplied to the weighing machines, and conversely (see page 11, line 13 - page 13, line 15). In the opinion of the Board, these operations are unambiguously feedback operations and since the accuracy of an apparatus controlled by a microprocessor is expectedly adequate, therefore, the argument is not considered as relevant.

2.6 Thus, the subject-matter of claim 1 lacks an inventive step (Art. 56 EPC) and Claim 1 is not allowable (Art.52(1) EPC).

2.7 The dependent claims 2 to 6 are concerned only with particular specific features, which are generally known, without any unexpected effect resulting from their use in the context of the techniques of D1 or D2 (see for instance the photocoupler IC3 in D2; see also the light-emitting diode LED and the coupled device of the photocoupler; see D1, Fig. 5 for a thyristor, Fig. 3 for a triac; moreover, the use of transistors as switching devices is generally known to people skilled in the art). Therefore, the subject-matter of each of the dependent claims 2 to 6 lacks an inventive step.

2.8 Therefore, the main request is not allowable.

3. Auxiliary request

3.1 Inventive step

3.1.1 Claim 1 according to the auxiliary request results from the combination of the claims 1, 2 and 3 according to the main request. Therefore, since no specific argument has

been provided by the Appellant concerning any unexpected effect resulting from the combination of the specific features of Claims 1, 2 and 3 of the main request, Claim 1 according to the auxiliary request is not allowable for the same reasons as those mentioned in relation to claims 1 to 3 according to the main request.

3.1.2 Claims 2, 3 and 4 of the auxiliary request correspond to Claims 4, 5 and 6 of the main request, respectively. Therefore, the Board is of the opinion that they are not allowable for the same reasons as those mentioned in relation to these Claims of the main request.

3.2 Thus, the auxiliary request is not allowable.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar

P.Martorana

The Chairman

E.Turrini

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