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D E C I S I O N
of 14 March 2005

Case Number: T 0685/03 - 3.4.3

Application Number: 95101434.9

Publication Number: 0668576

IPC: G07D 7/00

Language of the proceedings: EN

Title of invention:
Bill discriminating apparatus for bill handling machine

Patentee:
LAUREL BANK MACHINES CO., LTD.

Opponent:
Giesecke & Devrient GmbH

Headword:
Bill discriminating apparatus/LAUREL

Relevant legal provisions:
EPC Art. 56

Keyword:
-

Decisions cited:
-

Catchword:
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Case Number: T 0685/03 - 3.4.3

D E C I S I O N
of the Technical Board of Appeal 3.4.3
of 14 March 2005

Appellant: (Opponent)
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Representative:
-

Respondent: (Proprietor of the patent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 5 June 2003 rejecting the opposition filed against European patent No. 0668576 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: V. L. P. Frank
Members: G. L. Eliasson
T. Bokor

Summary of Facts and Submissions

I. The opposition against European patent No. 0 668 576 (patent in suit) was rejected in a decision of the opposition division dated 5 June 2003. In the decision, the following prior art documents, inter alia, were considered:

D1: DE-A-29 15 423; and

D3: DE-A-24 40 552.

The opposition was raised against the patent as a whole on the ground of lack of novelty and inventive step (Article 100(a) in combination with Articles 54 and 56 EPC).

II. The appellant (opponent) lodged an appeal on 26 June 2003, paying the appeal fee the same day. A statement of the grounds of appeal was filed on 9 October 2003 together with the following new prior art document:

D4: DE-A-39 16 298.

III. In response to a communication of the Board accompanying summons to oral proceedings, the respondent (patent proprietor) filed amended claims with a letter dated 4 February 2005.

IV. At the oral proceedings held on 14 March 2005, the patent proprietor filed amended description pages 2 and 3. The parties made the following requests:

The appellant (opponent) requested that the decision under appeal be set aside and that the patent in suit be revoked.

The respondent (patent proprietor) made the following requests:

Main Request:

Dismiss the appeal and maintain the patent in suit as granted.

First Auxiliary Request:

Set aside the decision under appeal and maintain the patent in suit on the basis of claims 1 to 6 according to the first auxiliary request filed with the letter dated 4 February 2005.

Second Auxiliary Request:

Set aside the decision under appeal and maintain the patent in suit on the basis of claims 1 to 3 according to the second auxiliary request filed with the letter dated 4 February 2005.

V. Claim 1 as granted and according to the patent proprietor's main request reads as follows:

"1. A bill discriminating apparatus for a bill handling machine comprising ultraviolet ray irradiating means (5) for irradiating bills (S) with ultraviolet rays,

light detecting means (6) for photoelectrically detecting visible light emitted from the bill (S)

to be discriminated and producing visible light detection signals,

visible light detection signal amplifying means (32) for amplifying the visible light detection signals produced by the light detecting means (6), and bill discriminating means (40)

characterized by

ultraviolet ray detecting means (20) for photoelectrically detecting ultraviolet rays emitted from the ultraviolet ray irradiating means (5) and producing ultraviolet ray detection signals,

said bill discriminating means (40) being adapted for receiving the visible light detection signals produced by said light detecting means (6) for photoelectrically detecting visible light emitted from phosphor materials contained in bills (S) upon being irradiated with ultraviolet rays, said visible light detection signals being amplified by said visible light detection signal amplifying means (32), and the ultraviolet ray detection signals produced by the ultraviolet ray detecting means (20) and discriminating bills (S),

said bill discriminating means (40) being adapted for adjusting an amplifying factor of the visible light detection signal amplifying means (32) in accordance with levels of ultraviolet ray detection signals input from the ultraviolet ray detecting means (20)."

VI. Claim 1 according to the first auxiliary request differs from that of the main request in that the following passage is added at the end:

"wherein said bill discriminating apparatus comprises a CPU (40) provided for receiving said ultraviolet ray detection signals and outputting amplifying factor adjusting signals on the basis of the received ultraviolet ray detection signals."

VII. Claim 1 according to the second auxiliary request differs from that of the main request in that the following passage is added at the end:

"and amplifying factor adjusting means (34) for adjusting an amplifying factor of the visible light detection signal amplifying means (32) and wherein the bill discriminating means (40) is adapted to output amplifying factor adjusting signals to the amplifying factor adjusting means (34) in accordance with levels of the input ultraviolet ray detection signals and the amplifying factor adjusting means (34) is adapted to adjust the amplifying factor of the visible light detection signal amplifying means (32) in accordance with the amplifying factor adjusting signals input from the bill discriminating means (40),

wherein the bill discriminating means (40) is adapted to store, as a threshold level, a level which is lower than a level of the ultraviolet ray

detection signal produced by the ultraviolet ray detecting means (20) and input into the bill discriminating means (40) when an amount of ultraviolet rays emitted from the ultraviolet ray irradiating means (5) is minimum and greater than a maximum level of the ultraviolet ray detection signal produced by the ultraviolet ray detecting means (20) based on an amount of ultraviolet rays transmitted through the bill (S) and input into the bill discriminating means (40) when an amount of ultraviolet rays emitted from the ultraviolet ray irradiating means (5) is maximum, and to output an amplifying factor adjusting signal to the amplifying factor adjusting means (34) in accordance with the level of the input ultraviolet ray detection signal only when the input ultraviolet ray detection signal exceeds the threshold level."

VIII. The reasons given in the decision under appeal for rejecting the opposition can be summarized as follows:

(a) The claimed device differs from that of document D1 only in that the bill discriminating means are adapted for adjusting an amplifying factor of the visible light detection signal amplifying means in accordance with levels of UV ray detection signals input from the UV ray detecting means, whereas in the apparatus of document D1, the threshold level for approving a bill is adapted in accordance with levels of UV ray detection signals.

(b) With respect to document D1, the objective technical problem relates to providing an alternative solution for avoiding the complicated trigger threshold circuit employed in document D1.

(c) When seeking a solution to the objective problem, the skilled person would attempt to make use of the components already present in the circuit of document D1. It would however not be a straightforward choice for the skilled person to use the output signal of the UV-light sensor 30 of the device of document D1 to control the amplifying factor of the amplifier 20 rather than controlling the trigger thresholds. Therefore, a combination of document D1 and the common general knowledge would not arrive at the claimed apparatus.

(d) The variable-gain amplifier described in document D3 is only used for simulating the desired spectral reflection of the reference surface and is not used for regulating the level of the output signal representing the detected light in accordance with the emitted light intensity of the UV-light source. Therefore, a combination of documents D1 and D3 does not lead to the claimed invention.

IX. The appellant (opponent) made essentially the following arguments in support of his requests:

(a) With respect to document D1, the technical problem addressed by the patent in suit relates to finding an alternative solution for stabilizing the bill

discriminating apparatus against variations in the intensity of the UV light. The skilled person faced with the above task would know that variations in intensity of UV-light can be compensated for either by adjusting the values of the reference values (trigger voltage), as in the apparatus of document D1, or by compensating the measured signals. As the first alternative is known from document D1, the skilled person would only have the second alternative (modifying the signal strength of the measured signal) to consider. It is also pointed out that document D1 gives a hint about the possibility of modifying the signal strength of the measured visible light intensity as a function of the measured intensity of the UV light (cf. claim 1, last three lines).

(b) The skilled person seeking a means for adjusting the signal strength in accordance with the intensity of the emitted UV-light would find from studying the signal path in the apparatus of document D1 that the only realistic alternative is to vary the gain of the amplifier 20.

(c) Documents D3 and D4 disclose apparatuses for discriminating bills where a variable-gain amplifier is used in order to ensure the long-term stability. Starting from document D1, the skilled person would therefore use a variable-gain amplifier in order to ensure stability of the apparatus. Therefore, the subject matter of claim 1 does not involve an inventive step.

X. The respondent (patent proprietor) presented essentially the following arguments in support of his requests:

(a) The solution offered in document D1 for achieving stability against variations in the UV-light intensity uses a trigger circuitry responding to the signal of the ultraviolet light detector which is rather complicated and has limited accuracy. It may therefore be considered as the objective of the present invention to provide an improved bill discriminating apparatus that allows bill discrimination with high accuracy irrespective of variations of the ultraviolet light intensity with a less complicated circuitry.

(b) The opponent ignores the fact that there are more alternatives for the skilled person how to improve the device of document D1, such as stabilising the light emission of the UV lamp itself.

(c) Document D3 uses a variable-gain amplifier to simulate the spectral properties of the reference surface, and does not vary the gain for regulating the level of the output signal of the detected light in accordance with the level of the intensity of the light source. Therefore, the teaching of document D3 does not fit together with that of document D1.

(d) In the device of document D4, the respective gains of the two amplifiers are adjusted to set the output of a differential amplifier to zero when light reflected from a counterfeit bill produced

with a B/W copying machine is detected. These settings are not automatically adjusted.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.

2. *Late filed document*

Document D4 was filed with the statement of the grounds of appeal and is therefore filed outside of the opposition period. The respondent has not requested that document D4 be disregarded but has provided arguments regarding the content of document D4. The Board considers moreover that document D4 is essential to the present decision, and therefore, admits document D4 into the proceedings.

3. *Amendments - First and Second auxiliary requests*

With respect to claim 1 as granted (main request), claim 1 according to the first auxiliary request further specifies that the "bill discriminating apparatus comprises a CPU (40) provided for receiving said ultraviolet ray detection signals and outputting amplifying factor adjusting signals on the basis of the received ultraviolet ray detection signals." This feature is disclosed on column 5, lines 19 to 28 of the application as published (cf. patent specification, column 5, lines 6 to 15). Claim 1 according to the second auxiliary request corresponds to claims 1, 4 and 5 as granted, which in turn, correspond to claims 1, 4

and 5 of the application as originally filed. These amendments clearly restrict the scope of protection of the patent in suit.

Therefore, the Board finds that the first and second auxiliary requests meet the requirements of Article 123(2) and (3) EPC.

4. *Inventive step - Main Request*

At the appeal stage, novelty of the claimed subject matter was not contested.

4.1 It is common ground that document D1 represents the closest prior art. It discloses an apparatus for detecting visible light emitted from phosphorescent materials contained in bills when irradiated with ultraviolet (UV) light (cf. Figure 1). The visible light detection signal (a) is fed to a trigger circuit 24 which approves a bill when the light detection signal exceeds a given threshold level. In order to compensate for fluctuations in the intensity of the emitted UV light, a UV light detector 30 measures the UV light intensity, and the threshold level of the trigger circuit 24 is adjusted in accordance with the level of the signal obtained from the UV light detector 30 (cf. paragraph bridging pages 7 and 8).

4.1.1 The subject matter of claim 1 according to the main request differs from the apparatus disclosed in document D1 in that the amplifying factor of the visible light detection signal is amplified in accordance with the level of the signal obtained from the UV ray detecting means. In the apparatus of document D1, the threshold level of the trigger circuit

24 is adjusted in accordance with the level of the signal measured by the UV ray detecting means 30 (cf. D1, Figure 1).

4.2 Document D3 discloses an apparatus for checking bills using visible light sources having different wavelengths (cf. Figure 1). The variable-gain amplifier 13 receives the detected visible light signal from the photodetector 7, where the gain of the amplifier 13 is adjusted to simulate a desired spectral reflection from a reference surface (cf. pages 9 to 10). The output signal is the weighted difference between the signal from the bill and the reference surface. Document D3 does not address the question of stability against variations of the light intensity.

4.3 Document D4 discloses an apparatus for checking bills using a visible light source 2 and two visible light detectors 3a, 3b for green and red light, respectively, detecting light reflected from the surface a bill B to be tested (cf. abstract; Figure 1). The signals from the two light detectors 3a, 3b are amplified in respective variable-gain amplifiers 5a, 5b and a differential amplifier 6 receives the signals from the two variable-gain amplifiers 5a, 5b. The gains 9a, 9b of the variable-gain amplifiers 5a, 5b are adjusted so that the output of the differential amplifier 6 is zero when a black-and-white photocopy of a bill is tested (cf. page 3, lines 16 to 18; equations 4, 6; page 4). In order to compensate for variations in the output signal from the differential amplifier 6 due to fluctuations in temperature and/or emitted light intensity from the lamp 2, the output signal from the differential amplifier 6 is divided by the output

signal from one of the variable-gain amplifiers 5b (cf. page 4, lines 6 to 17). Alternatively, the respective gains of the variable-gain amplifiers 5a, 5b can be adjusted in order to compensate for the above-mentioned fluctuations (cf. page 5, lines 8 to 14).

4.4 In the decision under appeal, it was held that the objective technical problem having regard to document D1 related to providing an alternative solution for stabilizing the bill discriminating apparatus against variations in the UV light intensity which avoids the complicated trigger threshold circuit employed in the apparatus of document D1. The Board however agrees with the opponent that the trigger circuits 23 to 25 used in document D1 have the function of digitalizing the signal into pass/fail, and that such a digitalizing of the signal is performed in the device of the patent in suit by A/D converters 31, 33 together with a CPU 40 (cf. item IX(a) above). The claimed device is therefore not less complicated than that of document D1.

Therefore, the objective technical problem having regard to document D1 relates to finding an alternative solution for stabilizing the bill discriminating apparatus against variations of the emitted UV light intensity.

4.5 In the device of document D1, a bill is approved if the signal level input from the visible light detector 16 is higher than a threshold level. Since the signal level from the visible light detector varies with the intensity of the UV light irradiated on the bill, the circuit of document D1 has to be stabilized against such variations. As the opponent convincingly argued,

the skilled person analysing the circuit displayed in Figure 1 of document D1 would realise that there are basically two ways of stabilizing this type of circuit against fluctuations in the UV light intensity: Either the threshold level, as in document D1, or the signal level from the visible light detector 16 has to be adjusted in accordance with the measured UV light intensity (cf. item IX(b) above).

The skilled person seeking an alternative for stabilizing the bill discriminating apparatus against variations of the UV light intensity would thus realise that the signal level from the visible light detector could equally well be adjusted in accordance with the measured UV light intensity, and that such adjustment of the signal level would be obtained by varying the level of amplification of the signal from the visible light detector.

As pointed out by the opponent, variable-gain amplifiers are commonly known in the art, see for example documents D3 and D4 (cf. item IX(c) above). Furthermore, as mentioned under item 4.3 above, document D4 also suggests the possibility of adjusting the gain of the variable-gain amplifiers 5a and 5b in order to compensate for variations in emitted light intensity. The Board therefore does not see any merit in modifying the circuit of the device of document D1 so that the threshold level of the trigger circuit 24 is held at a fixed value and the amplifier 20, which amplifies the signal from visible light detector 16, is replaced by a variable-gain amplifier where the gain of the amplifier is varied in accordance with a signal derived from the UV detector 30.

4.6 The patent proprietor argued that the skilled person faced with the above problem would rather seek to stabilize the intensity of UV light emitted from the UV light source than looking for alternative solutions for adapting the discriminating circuit (cf. item X(b) above).

The Board is however not convinced by this argument, since the apparatus of document D1 uses a gas discharge lamp as UV light source (cf. 5, third paragraph). It is however difficult to control accurately the intensity of the light emitted by gas discharge lamps. Therefore, the skilled person would not consider this to be a realistic alternative.

4.7 For the above reasons, the subject matter of claim 1 according to the main request does not involve an inventive step within the meaning of Article 56 EPC.

5. *Inventive step - First auxiliary request*

5.1 With respect to claim 1 according to the main request, claim 1 according to the first auxiliary request further specifies that the "bill discriminating apparatus comprises a CPU (40) provided for receiving said ultraviolet ray detection signals and outputting amplifying factor adjusting signals on the basis of the received ultraviolet ray detection signals."

5.2 Although none of the cited prior art documents discloses a bill discriminating apparatus comprising a CPU, the Board finds that use of a CPU for receiving the ultraviolet ray detection signals and outputting

the corresponding amplifying factor adjusting signals lies in line with the general trend in technology and thus cannot be considered inventive.

Therefore, the subject matter of claim 1 according to the first auxiliary request does not involve an inventive step within the meaning of Article 56 EPC.

6. *Inventive step - Second auxiliary request*

6.1 With respect to the main request, claim 1 according to the second auxiliary request further contains the features of claims 4 and 5 as granted. These features have the technical effect that the UV light detecting means 20 also detects the presence of a bill S in the path of the UV rays emitted from the UV lamp 9 and that the amplification factor of the visible light detection signal is only adjusted when no bill is present in the UV light path. Document D1, on the other hand, is silent as to detecting the presence of a bill.

6.2 The objective technical problem thus relates to finding a means of detecting the presence of a bill and accurately measuring the intensity of the UV light which falls on a bill, when a bill is present in the bill discriminating machine.

6.3 Although means for detecting the presence of a bill are known from e.g. document D3, Figure 1, these means use separate light sources and separate light detecting means 27, 28. Furthermore, since the UV light detector 30 of the device of document D1 is positioned adjacent to the UV lamp 1, the apparatus of document D1 would have to be redesigned in order to allow the UV light

detector to be used for detecting the presence of a bill in the UV light path. Since the available prior art does not contain any hint for using the UV lamp and UV light detector also for the purpose of detecting the presence of a bill in the apparatus, the skilled person would have no reason to carry out the modifications of the apparatus of document D1 required for arriving at the claimed subject matter.

6.4 For the above reasons, the subject matter of claim 1 according to the second auxiliary request involves an inventive step within the meaning of Article 56 EPC.

6.5 Since claims 2 and 3 according to the second auxiliary request are dependent claims, the subject matter of these claims involves an inventive step as well.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain a patent on the basis of the following:

   – Claims 1 to 3, filed on 4 February 2005 with the second auxiliary request

   – with the description pages 2 to 3 as presented during oral proceedings
   pages 4 to 5 as granted

   – Figures 1 to 2 as granted.

The Registrar: The Chairman:

P. Cremona V. L. P. Frank