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Bezeichnung der Erfindung: Toner density detecting device
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : G03G 15/09

ENTSCHEIDUNG / DECISION
vom / of / du 5 April 1990

Anmelder / Applicant / Demandeur : 01 Kabushiki Kaisha Toshiba
02 Toshiba Automation Equipment Engineering Ltd.

Patentinhaber / Proprietor of the patent / Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé : "Inventive step (yes, after limitation)"

Leitsatz / Headnote / Sommaire

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Case Number : T 20/89

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 5 April 1990

Appellant : 01 Kabushiki Kaisha Toshiba
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Decision under appeal : Decision of Examining Division 044 of the European Patent Office dated 22 August 1988 refusing European patent application No. 85 105 067.4 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : J.D. Roscoe
Members : H.J. Reich
L.C. Mancini

Summary of Facts and Submissions

I. European patent application No. 85 105 067.4 (publication number 0 163 136) was refused by decision of the Examining Division.

II. That decision was based on Claim 1 as filed on 3 July 1987 and Claims 2 to 9 as originally filed. The ground for the refusal was that the subject-matter of none of the claims involved an inventive step having regard to the prior art arrangement shown in Figs. 1 and 2 of the application itself in conjunction with the normal skill of a technically trained person.

III. The Appellants (Applicants) lodged an appeal against this decision.

IV. In a communication of the Board pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal the rapporteur drew the Appellants' attention to the following documents:

(1) US-A-3 892 672
(2) GB-A-1 367 681
(3) DE-A-2 141 870
(4) US-A-4 147 127
(5) EP-A-3 134
(6) DE-A-2 525 952
(7) US-A-3 872 824 (erroneously referred to as US-A-3 172 824 in the communication but identified by the Appellant)

all published before the priority date claimed for the application in suit and expressed the provisional opinion that the subject-matter of the claims did not involve an inventive step.

V. At the oral proceedings, after discussion of the issues, the Appellants withdrew the existing claims and requested that the decision under appeal be set aside and that a patent be granted on the basis of new Claims 1 and 2, pages 1, 2, 2a and 3 to 7 of description and Figs. 1 to 6 of drawings, all as handed over at the oral proceedings.

Claim 1, the sole independent claim, reads as follows:

"A toner density detecting device which detects the toner density of a developing agent by measuring the inductance of a coil determined by the permeability of the carrier of the developing agent, comprising:

a housing (11) in which there is buried the coil (12), one end of the coil being exposed from a surface of the housing to extend towards the flowing developing agent; and

a cover member (13) provided on said one end of the coil to prevent the developing agent from touching the coil,

characterized in that

in a plane perpendicular to the central axis of the coil (12) the cover member (13) is shaped like an isosceles triangle (ABC) whose apex (A) is at the upstream end with respect to the flowing direction of the developing agent and in a perpendicular plane thereto near to the said surface of the housing (11), the bisecting line of the apex angle (α) crossing the central axis of the coil (12), and in side view perpendicular to the flowing direction of the developing agent is shaped like a right-angled triangle (ACD) comprising a horizontal base (AC) and a vertical side (CD) lying at the downstream end of the cover member (13) with respect to the flowing direction of the developing agent."

VI. The Appellant argued essentially as follows:

The problem to be solved by the invention was how to overcome or materially reduce the difficulty of obtaining accurate toner density measurements caused by high frequency noise in the output of the prior art toner density detecting device described with reference to Figs. 1 and 2 of the description of the application in suit.

In the device described in documents (1) to (3) this problem did not arise and these documents could not therefore and in fact did not provide the skilled person with any hint which might lead him to the cover configuration now claimed and nor did documents (5) and (6).

The skilled person could not directly infer from the disclosure in document (4) that precise detection of toner concentration calls for even flow of the toner past the detecting device. Furthermore there was no way in which features of the devices disclosed in the said Figs. 1 and 2 and in document (4) could be combined to produce the device claimed. Furthermore a skilled person would not, in the absence of some strong prior art indication to that effect, automatically attribute an unstable measuring signal to the manner in which the developer flows in the vicinity of the measuring coil or to clogging of the developer in this region since there were other possible causes. Moreover it was not admissible to assume that the expert in a given field had knowledge going beyond that disclosed in the relevant prior art, represented in this case by the cited documents. Such a person would not, even if possessing such knowledge, assume that provisions for assuring even flow of air or snow in specific situations would result in even flow of particulate developing agent in a different situation i.e. in a toner density measuring

device, where the purpose of assuring a smooth flow was different.

The Appellant had not only discovered that the manner in which the developer flowed was the cause of the measuring instability but had removed this cause by replacing the prior art cover by a cover of a particular configuration, essentially that described with reference to Figs. 4 and 5 of the application, which was not disclosed in any one of the cited documents, but which provided a substantial improvement in measuring stability not only over that achieved by the prior art cover but also over that afforded by the covers of the now withdrawn embodiments.

Reasons for the Decision

1. The appeal is admissible.

2. The documents on which the Appellants' request is based do not contain subject-matter which extends beyond the content of the application as originally filed. The subject-matter of Claim 1 lies wholly within that of the correspondingly numbered original claim when construed in the light of the description as a whole. The preamble of the claim corresponds in substance to that of the original claim and the characterising part consists exclusively of features of the cover member construction shown in the original Figs. 5A to C, described in the terms used in the supporting passage at page 4, lines 8 to 21 of the original description. The only other claim, Claim 2, corresponds to original Claim 4.

In the description and drawings the only amendments apart from correction of obvious errors consist in the insertion of an acknowledgement of certain features of the toner density detector described in document (4), replacement of

the original statement of invention by one corresponding to the current claim 1 and cancellation of Figures and associated description of arrangements outside the scope of the current claims.

There is, therefore, no objection under Article 123(2) EPC to the application documents in their present form.

3. **Novelty**

3.1 None of the documents (1) to (7), nor the other three documents cited in the European Search Report discloses a toner density detecting device as claimed in Claim 1.

3.2 Thus none of the last three mentioned documents nor documents (5) and (7) make use of a coil for measuring toner density, while in document (6) the developing agent flows axially through the centre of the measuring coil rather than past one end of it.

3.3 In the apparatus of document (4) there are three flat coils mounted on a common support bolted to the outside of a container for developer material. The coils, which have a common axis, are optionally individually moulded in varnish or plastic and are each disposed entirely within the developer which flows normal to said axis. Thus not only is the position of each coil in relation to the developer volume different from that claimed but there is no cover member at all over an exposed end of a coil housing.

3.4 In the essentially identical apparatuses disclosed in documents (1), (2) and (3) the measuring coil 238 is buried in a plastic housing 240 at a surface of which one of its ends is exposed and extends towards the flow of developer. However the end of the coil does not extend

beyond the housing surface as Claim 1 is understood to require but is flush with it and the only cover member provided is a flat Mylar sheet rather than a member having a configuration as defined in the characterising part of the claim.

3.5 The closest prior art is in the Board's opinion the undocumented device described with reference to Figs. 1 and 2 of the application in suit and referred to there and throughout the appeal proceedings by the Appellant as prior art. This has the combination of all the features of the preamble of Claim 1. However the cover member for the end of the coil is simply a short hollow cylinder coaxial with the coil closed at the end remote from the housing surface by a flat surface.

3.6 Therefore the subject-matter of Claim 1 and hence also that of appendant Claim 2 is novel in the sense of Article 54 EPC.

4. **Inventive step**

4.1 In the undocumented prior art device referred to above in which the coil axis is normal to the direction of flow of the developing agent, the coil cover projects into the developing agent, wich is carried past it on a magnetic roller through a relatively confined space. According to page 2, lines 14 to 16 of the application itself, in such an arrangement the developing agent is liable to flow unevenly thus clogging the passage between the roller and the flat surface of the cover and hence giving rise to high frequency noise in the detecting coil.

Thus the objective problem to be overcome is how to eliminate the cause of this noise and the Board has no cause to doubt that the claimed device achieves this.

4.2 Although none of the available documents makes any reference to such noise in an arrangement operating on generally the same principle as the undocumented device the Board is satisfied that the skilled person operating such a device would sooner or later become aware of its shortcomings and would have good reason to suspect that one possible cause, meriting further investigation, might be clogging or blocking of the flow of developer past the detector coil, which would lead to what is measured not being consistently that of the developer which has just left the developing area. From routine consideration of the mode of operation he would also recognise that any resulting increase in the density of the developer below the coil would also give rise to an apparent increase in carrier concentration.

There are in fact numerous indications in the cited prior art that developer does have a tendency to cake, especially if damp and of an awareness that there is a risk of clogging in toner density measuring devices which can lead to unreliability in the measurement.

Thus:

(a) document (5) at column 3, lines 30 to 41 refers to the risk of blocking by toner becoming solidified under pressure at the pinch between the flat surface of a photoconductive imaging member and the curved surface of the brush carrier, and alleviating this condition by increasing the spacing at the pinch;

(b) document (6), at pages 13 and 14 refers, in connection with a device in which the development mixture flows through a wide tube surrounded by the sensing coil, to the effects of possible flow instability and blockage on the measurement;

(c) lines 26 to 29 of column 4 of document (4) imply that disturbance of the developer flow leads to unstable toner concentration measurement: the detector is therefore arranged so as not to disturb the flow, and lines 53 to 57 of column 1 thereof state that the presence of coils within the developer in a prior art device disturbs homogeneous circulation flow of the developer, resulting in a lack of uniformity in the magnetic brush.

Document (1) on the other hand refers to the well-known phenomenon of caking in the hopper for the developer (column 5, line 64) and to measures to avoid build-up of toner adjacent the coil and attraction of developer mix to the coil end, column 6, lines 23 to 25 and 31 to 33, both of which are considered detrimental.

4.3 All this confirms the Board's opinion that there is a general awareness in the art that any arrangements which lead to irregular flow of the two component developer will cause unreliability in toner density measurement and are therefore to be avoided.

4.4 The skilled person confronted with irregular flow or blockage in the undocumented prior art arrangement of Figs. 1 and 2 and required to overcome it by modifying the detecting unit rather than the copying machine as a whole would recognise that the most likely place for blocking to be initiated is the step surface at the leading edge of the cover where the depth of the channel available for flow of developer is suddenly reduced, even if inspection did not reveal any evidence of blocking at this point, since it is common experience that dust and other powder and granular materials tend to accumulate at such discontinuous changes in level but can surmount more gradual slopes. In the situation under consideration the

skilled person might first consider lowering the main surface of the cover to eliminate or reduce the step but the requirement that the coil has to extend into the brush does not permit this. This leaves the possibility of eliminating the discontinuity by simply chamfering or curving the leading edge of the cover, which would lead directly to a construction within the scope of the Claim 1 rejected by the Examining Division, when that claim is construed in the light of the description as a whole. Routine testing would show such a configuration to be effective.

4.5 Accordingly the Board considers that the Examining Division was right to refuse the application.

4.6 It does not however share the view expressed by the Examining Division in its decision that a claim directed to the embodiment shown in Figs. 4 and 5 (such as the present Claim 1) would be lacking in inventive step. The fact, if indeed it is a fact, that a multiplicity of geometrical shapes may approach an ideally streamlined form does not mean that the skilled person would see them all as likely to provide a pattern of developer flow which would overcome or alleviate the problem with the undocumented prior art arrangement or be able to select that likely to achieve the best result. The rounded off version of the prior art form found to be obvious by the Board (see item 4.4 above) and those shown in cancelled Figs. 7 and 8 of the application can be recognised as streamlined versions of that used in the prior art. On the other hand the configuration now claimed represents a radical departure from this line of development. Furthermore it does not correspond to a shape used in the various rather remote applications of streamlining referred to by the Examining Division in the proceedings culminating in the appealed decision, nor to any shape disclosed in the cited documents. Though the shape is

similar to the bow of a ship and recognised by the Board as reminiscent of a snowplough the Board after careful consideration can see no reason why a skilled person should without hindsight have recognised it as a solution to his problem since the effect of the shape in the known applications is rather to push the fluid aside and would thus be expected in the situation under discussion to divert the developer away from the vicinity of the coil rather than causing it to flow evenly over it as required for lowering the signal noise.

4.7 For these reasons the subject-matter of Claim 1 and hence also that of appendant Claim 2 involves an inventive step.

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 grant a patent on the basis of the following documents:

- Claims 1 and 2
- pages 1 to 7, including 2a, of description, and
- Figs. 1 to 6, all as handed over at the oral proceedings.

The Registrar: The Chairman:

M. Beer J.D. Roscoe

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