BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 28 January 2000

Case Number: T 0932/97 - 3.2.3

Application Number: 91830478.3

Publication Number: 0484303

IPC: B24B 21/08

Language of the proceedings: EN

Title of invention:
A sanding machine for timber boards

Patentee:
SCM GROUP AUTEC DIVISION S.p.A.

Opponent:
KARL HEESEMANN Maschinenfabrik GmbH & Co.KG

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0932/97 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 28 January 2000

Appellant: (Opponent)
KARL HEESEMANN Maschinenfabrik GmbH & Co.KG
Reuterstrasse 15
D-32547 Bad Oeynhausen (DE)

Representative:
Lins, Edgar, Dipl.-Phys. Dr.jur.
GRAMM, LINS & PARTNER
Theodor-Heuss-Strasse 1
D-38122 Braunschweig (DE)

Respondent: (Proprietor of the patent)
SCM GROUP AUTEC DIVISION S.p.A.
Strada Statale 258 Marecchia, 57
I-47040 Villa Cerucchio (Rimini) (IT)

Representative:
Lanzoni, Luciano
c/o BUGNION S.p.A.
Via Goito, 18
I-40126 Bologna (IT)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 26 June 1997 rejecting the opposition filed against European patent No. 0 484 303 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: C. T. Wilson
Members: J. du Pouget de Nadaillac
J. P. B. Seitz

Summary of Facts and Submissions

I. The appeal is directed against the decision dated 26 June 1997 of an opposition division of the EPO, which rejected the opposition filed against the European patent EP-B1-0 484 303.

II. This patent comprises three independent claims, namely Claims 1, 3 and 7, which read as follows:

Claim 1:

"A sanding machine for timber boards, comprising at least one sanding head (1) consisting substantially in a set of rolls (3) with parallel axis disposed transversely and above a conveyor table (4), and an abrasive belt (5) looped around and tensioned by the rolls, wherein the space between at least two successive rolls (3) riding close to the table (4) is occupied by a plurality of pressure pads (6), disposed one beside the next along an axis parallel with the longitudinal axis of the rolls (3) and offered in sliding contact to the reverse side of the abrasive belt (5), each capable of movement toward and away from the conveyor table (4) through the agency of associated support and control means (7) mounted to a beam (8), dynamically independent one from another and interlocked in operation to sensing, monitoring and control means (9),

characterized in that each of the support and control means (7) consists in an electromagnetic (E) comprising:

- a central rod (10) slidable vertically within and in sealed association with a relative seating (11) afforded by the beam (8), of which the bottom end is made fast to the relative pressure pad (6) and a substantially central portion is unsheathed by a rigidly associated annular element (12) fashioned from permanent magnetic material;

- a pair of fixed solenoids (13, 14) each wound around a corresponding fixed annular element or core (15, 16) of ferromagnetic material freely and coaxially ensheathing the rod (10), positioned on opposite sides of the annular element (12) and set apart one from the other at a distance such as to compass the full stroke of the rod toward and away from the conveyor table, through which respective currents are passed in opposite directions so as to generate and sustain corresponding magnetic fields of which the polarities at the two ends (13a-13b, 14a-14b) of the solenoids (13, 14) are respectively opposite, thereby obtaining **like** polarities between each base surface (12a, 12b) of the permanently magnetic annular element (12) and the corresponding end (13a, 14a) of each solenoid, and inducing two respective **repulsion forces (F, F1)** to which the annular element (12) is exposed on either side; and in that sensing, monitoring and control means (9) comprise a plurality of transducers (20) positioned to intercept the incoming board (2), by which respective output voltage signals proportional in value to the thickness of the board are generated and relayed to an electronic processor (25) capable of controlling the value of the currents

directed through the solenoids (13, 14) in proportion to the voltage signals received from the transducers (20), and thus of modulating the value of the **repulsion forces (F, F1)** according to the thickness of the board as sensed by the transducers."

The bold type of two terms in this claim is introduced by the Board. The reason for this bold type is explained by the following reference to Claim 3.

Claim 3: This claim has the same wording as Claim 1 with the only following differences concerning the terms in bold type of Claim 1: "like" is replaced by "unlike", and "repulsion forces (F, F1)" by "attraction forces (Fa, Fa1)". "

Claim 7:

"A sanding machine for timber boards, comprising at least one sanding head (1) consisting substantially in a set of rolls (3) with parallel axis disposed transversely and above a conveyor table (4), and an abrasive belt (5) looped around and tensioned by the rolls, wherein the space between at least two successive rolls (3) riding close to the table (4) is occupied by a plurality of pressure pads(6), disposed one beside the next along an axis parallel with the longitudinal axis of the rolls (3) and offered in sliding contact to the reverse side of the abrasive belt (5), each capable of movement toward and away from the conveyor table (4) through the agency of associated support and control means (7) mounted to a beam (8), dynamically independent one from another and

interlocked in operation to sensing, monitoring and control means (9),

characterised in that each of the support and control means (7) consists in an electromagnet (E) comprising:

- a central rod (10) slidable vertically within and in sealed association with a relative seating (11) afforded by the beam (8), of which the bottom end is made fast to the relative pressure pad (6) and a substantially central portion in unsheathed by a rigidly associated annular element (12) fashioned from permanent magnetic material;

- a fixed solenoid (13) positioned above the annular element (12), wound around a corresponding fixed annular element or core (15) in ferromagnetic material freely and coaxially ensheathing the rod (10), and set apart from the annular element (12) at a distance fully compassing the stroke of the rod toward and away from the conveyor table (4), through which current is passed in a direction such as to generate and sustain a magnetic field of which the polarity at the end (13a) of the solenoid (13) directed toward the permanent magnetic annular element (12) is the same as the polarity of the corresponding base surface (12a) of the annular element, thereby inducing a repulsion force (F) to which the annular element (12) is exposed on one side;

- a spring (28) coaxially ensheathing the rod (10) on the side of the annular element (12) opposite to the solenoid (13), retained at the one end by

the annular element (12) and at the remaining end by the bottom end of the seating (11), of which the function is to return the rod (10) elastically in response to a weakening of the repulsion force (F) induced by the solenoid (13); and in that sensing, monitoring and control means (9) comprise a plurality of transducers (20) positioned to intercept the incoming board (2), by which respective output voltage signals proportional in value to the thickness of the board are generated and relayed to an electronic processor (25) capable of controlling the value of the currents directed through the solenoids (13,14) in proportion to the voltage signals received from the transducers (20), and thus of modulating the value of the repulsion forces (F, F1) according to the thickness of the board as sensed by the transducers."

III. In the decision under appeal, the opposition division held that the ground of lack of an inventive step invoked by the opponent against the patent did not prejudice the maintenance of the patent as granted having regard to the following prior art documents filed during the opposition proceedings:

E1: EP-A-0 155 380

E2: "Elektromagnetische Wandler und Sensoren", Kontakt und Studium, Elektronik, Bd. 219, expert verlag, 1989.

E3: "An optimized magnet-coil force actuator and its application to precision elastic mechanisms",

Proceedings of the Institution of Mechanical Engineers, Part C (Journal of Mechanical Engineering Science), Vol. 204, No. 4, Sept. 1990, pages 243 to 253.

E4: "Linear Position Control Using Simple Solenoids and an Electromagnet", SAE Technical Paper Series, 10 to 13 September 1990.

IV. The appeal was lodged on 2 September 1997 and the appeal fee paid at the same time. Together with the statement setting out the grounds of appeal, which was received on 3 November 1997, the appellant (opponent) filed two new documents, namely:

E5: DE-C2-38 17 110 and E6: DE-A1-35 39 145, this last document being cited against Claim 7.

The respondent (patentee) challenged the admissibility and relevance of these documents.

V. In a communication dated 18 March 1999 accompanying the summons to oral proceedings, the Board expressed its provisional opinion that, as far as documents E1 to E4 were concerned, they did not suggest the subject-matter of Claim 1, that further the relevance of E5 was doubtful and that the arrangement of the electromagnetic device according to E6 did not correspond to that according to Claim 7 of the patent in suit.

In a letter dated 12 May 1999, the appellant indicated that she would not participate in the oral proceedings and withdrew the request therefor. The oral proceedings

were cancelled.

VI. The appellant argued as follows:

Document E1 already discloses a sanding machine comprising electromagnetic devices, which control the linear pressure forces applied on the abrasive belt, instead of applying constant forces. Important is to see that E1 already teaches to apply a linear drive. The only difference of the subject-matter of the three independent claims of the patent in suit is therefore the kind of electromagnetic device which was chosen, namely a pair of solenoids arranged around the central rod of each pressure pad or a single solenoid cooperating with a spring acting in the opposite direction. The problem which was solved is therefore to be seen as the problem of a linear drive by electromagnetic actuators. It follows that the person skilled in the art for such a problem is the specialist in electromagnetic drives. The citations E2 to E4, each, describes linear driving devices having a central element, the position of which is controlled by means of two solenoids respectively located on opposite ends of said element and energized by suitably controlled currents.

In the decision under appeal, the opposition division argued that these documents were not concerned with dynamically balanced forces and the control thereof. Document E5 shows however that it was known to use balanced forces for the control of a valve, whereas E6 discloses the control of balanced forces by means of an electromagnet counteracted by a spring. The fact that these documents mainly deal with the control of the

suitable position of an element, and not with the control of forces, is not relevant for the evaluation of an inventive step, since the person skilled in the art, who looks for appropriate solutions in order to solve the problem of a linear drive, immediately realizes that, instead of a zero-position due to equal opposite forces, it is also possible to obtain variable pressure forces by modifying the opposite forces. The present invention discloses no particular advantage resulting from the claimed subject-matter, so that in fact with the patent in suit a protection is wanted for solutions, which are obvious as such.

VII. The respondent essentially argued against the documents E5 and E6: they should not be admitted into the proceedings, since they are not relevant. E5 says nothing more than E3 and, further, it is not concerned with the problem of creating a force. E6, also, does not deal with this problem. What is taught in this last prior art is only to use the force of a spring in order to render a magnetic drive stable at different positions.

VIII. The appellant requested the decision under appeal to be set aside and the whole patent to be revoked.

The respondent requested the appeal to be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. In the claims of the patent in suit, having regard to the whole disclosure of this patent, the term "electromagnet" means in fact the whole electromagnetic device of each support and control means according to the present invention. Each electromagnetic device disclosed as solution in the patent in suit can comprise between one and three electromagnets. Usually, a solenoid is only an electrical conductor wound as a helix with a small pitch on an insulated cylindrical form. In an electromagnet, the same windings, which are called a "solenoid" in the patent in suit, are, as specified by the claims, located on a soft electromagnetic material or core, which magnetizes by induction on passing a current through the winding and enhances the magnetic field. Therefore, to avoid any confusion in the present decision, the term "electromagnet" used in the claims of the patent in suit is in the present decision given as the "electromagnetic device" and the solenoids are to be understood as the coils of the electromagnets.

3. It is not disputed that the sanding machine as disclosed in document E1 represents the closest prior art. The device described in this prior art comprises all the features of the pre-characterising part of the three independent claims. It further discloses the features of the last part of these claims just after the last semicolon, which concerns the sensing, monitoring and control means, a single solenoid however being used in this prior art device as is the case in the embodiment according to the granted Claim 7 of the patent in suit.

Moreover, following the wording of the first lines of

the characterising portion of these independent claims of the patent in suit, each of the support and control means of this known device consists in a single electromagnet together with a central and vertically displaceable rod, of which the bottom end is made fast to the relative pressure pad. Contrary to the interpretation of this prior art made by the opposition division, no indication is provided as to the arrangement of the central rod relative to the electromagnet; it is not clear whether the central rod is part of a magnet core or of a magnetic plate. On the other hand, although it is also not explicitly indicated in this document, the central rod must be held by the beam of the sanding head because of the lateral forces exerted on the pads by the moving of the abrasive belt. Therefore, what can be deduced from the whole content of this disclosure is that, on the one hand, the central rod is vertically slidable and in sealed association with a relative seating afforded by the beam and, on the other hand, that the electromagnet shifts the central rod of each support and control means, giving rise to a variable pressure force, which acts vertically on the corresponding pad against the opposite force of the abrasive belt (see E1, column 5, lines 41 to 43) and is proportional to the current flowing through the electromagnet.

3. The subject-matter of Claims 1, 3 and 7 differs from this known device by the following features:

In all three claims:

The central rod is slidable vertically **within** the electromagnetic device and a substantially central

portion of the central rod is ensheathed by a rigidly associated annular element fashioned from permanent magnetic material,

with further in Claims 1 and 3, the electromagnetic device, which consists of:

a pair of fixed solenoids with a fixed annular core made of ferromagnetic material (thus, a pair of electromagnets), coaxially ensheathing the central rod and each positioned on opposite sides of the central annular element of said central rod, magnetic fields being created by currents passing in opposite directions through the solenoids, inducing either repulsive forces (Claim 1) or attractive forces (Claim 3) according to the respective arrangement of the polarities of the solenoids and annular element,

whereas, according to Claim 7, the electromagnetic device consists of a single electromagnet associated with a spring coaxially ensheating the central rod on the side of the annular element opposite to the electromagnet and acting in the direction opposite to the repulsive force of the electromagnet.

4. The respondent agreed that this prior art E1 solves the general problem of regulating the pressing force exerted on the planing belt so as to prevent involuntarily rounding of the edges of the treated board during the sanding treatment and to maintain a constant sanding pressure, continuously adjusted according to the external profile, in particular the eventually variable thickness, of the treated board.

The opposition division in its decision under appeal held that the problem solved by the machines according to claims 1, 3 and 7 of the patent in suit consisted in developing a suitable, dynamically balanced electromagnetic device, an effect of the present invention which is disclosed in the description of the patent in suit, column 5, lines 17 to 23. However, as seen above, document E1 also indicates that the forces exerted by the sanding belt act against the magnetic forces of the electromagnet, so that here also a dynamic balanced system can be considered to exist, even if the opposed forces are not exactly the same as in the present invention. Thus, the problem as set out by the opposition division was already solved in the prior art E1, however in a different way.

As indicated by the claims, the repulsive or attractive force(s) of the electromagnets are modulated according to the thickness of the board as sensed by the transducers. However, the solution as claimed differs from the solution according to E1 in that a closed-circuit pressure control system is obtained, so that the dynamic balance system essentially relies upon the opposed forces induced by the electromagnets (or by an electromagnet and a spring), rather than upon the forces induced by a single electromagnet opposed to the forces exerted by the sanding belt.

Therefore, the problem to be solved underlying the present patent is to be seen in the provision of a specific structure for pressure regulation, capable of modulating and adjusting the forces on each pad of a sanding machine in a better way then the device according to E1.

5. It remains to examine whether the cited prior art suggests the solution as claimed.

6. The pages of document E2 which were filed concern the construction of electromagnetic linear drives for short or long tracks, as used in measurement instruments, typing machines, centralised locking devices for cars. These kinds of devices imply small moving masses and small forces, which are not comparable with those of a sanding machine.

There is no suggestion in this document of regulating by means of electromagnets the forces applied on a surface, which itself brings variable forces directed in the opposite direction. The person skilled in the art, who is confronted with the above problem, has therefore no reason to consider this document.

The appellant has pointed out two constructions shown in this prior art, namely those of respectively Figure 2.13(b) on page 33 and Figure 2.18, page 36. The first construction, which is described to have been used for displacing an element of a typing machine along a straight course, comprises a permanent magnet moving on a rail, which is realized as an electromagnet. This kind of construction cannot suggest either a construction with two opposed electromagnets

or one with an electromagnet acting against a spring. Moreover, the document indicates that this construction is not advantageous, being rather inefficient. The second construction, namely that according Figure 2.18, concerns the construction of an on/off switch of a car with a movable permanent magnet switching between two opposed positions. A solenoid surrounding a static permanent magnet is fixedly located at each one of both opposed positions. The movable magnet is kept by the static permanent magnet in one position and, once attracted by a magnetic pulse coming from the opposite solenoid, quickly moves from the one position to the opposite position, in which it is then kept by the corresponding fixed magnet. This bistable construction cannot suggest the use of electromagnets for providing modulated forces.

7. Document E3 concerns **Micro**engineering and Metrology, the abstract mentioning a displacement range of 100nm to 50µm. It is therefore quite doubtful whether a person skilled in the art faced with the problem of applying forces suitable for sanding timber boards would have made searches for a solution to this problem in the technical field according to E3. This citation emphasizes that electromagnetic force actuators are to be used for applications involving very small displacements and, further, it essentially deals with the problem of obtaining ultra-high precision displacements, and not adjusted forces. Solenoids, and not electromagnets, are shown, with the consequence that the magnet must remain inside the coil, since the magnetic field of a sole solenoid is not able to move a ferromagnetic element situated outside of the coil, only an electromagnet can do so. Moreover, the

arrangement shown in Figure 7(b), page 248 of this document, concerns a spring mechanism combined with a four-magnet-two coil force actuator. It is not clear how these solenoids and the complicated arrangement of Figure 7 can suggest the solution as claimed. The mention of this document is clearly the result of an a posteriori search.

8. Document E4 concerns the use of solenoids and electromagnets in applications, such as switches, relays and valves, which do not require high forces. The object of this citation is to provide a device which achieves infinite positions of an actuator. The solution proposed consists in a movable shaft supporting two plungers of mild steel, which are spaced from each other and each movable inside a solenoid fixedly secured on the frame of the device. An electromagnet is also fixed on said frame, close to the movable shaft and between both plungers. Pulse signals are sent by a microprocessor to activate the solenoids and the electromagnet: because of the plungers located on the movable shaft inside the opposed solenoids, the shaft can be slightly displaced along its axis in one or the other direction, but the electromagnet is only used for latching the shaft in a given position. This device does not correspond to the electromagnetic devices mentioned in Claims 1, 3 and 7 of the patent in suit. Only solenoids are acting on the plungers, not electromagnets, so that here also the plungers must remain inside the coils, and moreover high forces cannot be obtained. Thus, the consideration of this document is also to be seen as the result of an a posteriori view.

9. The same observations can be applied to document D5, the basic object of which is to bring the movable actuator of a hydraulic valve into a neutral position between two extreme positions. More particularly, this document aims at controlling the displacement of the actuator, so that it exactly responds to the provided electrical signals. As soon as the repulsive forces generated by the two solenoids are not equal (thus out of an equilibrium state), the actuator should "jump" to one of the two extreme positions. This problem is quite different from that of the present invention. Moreover, it is not clear how the arrangement shown in Figure 3 of this document could be applied in a sanding machine. Therefore, this document is not appropriate to deny an inventive step for the subject-matter of Claims 1, 3 and 7.

10. The appellant has opposed document E6 to the subject-matter of Claim 7, since this prior art teaches the cooperation of an electromagnet with a spring in order to obtain an exact positioning of the adjusting element of, for example, a valve or gas pressure regulator. Thus, like the preceding citation, this document deals with the control of positions, not with the control of forces, especially as the object of this document is to realize the equilibrium between the force of an electromagnet and the opposed force of a weak spring plate by means of an electrical current as low as possible, and that particularly in the case of a low gap between the movable armature and the core of the electromagnet. As the solution, it is proposed to progressively change by mechanical means the stiffness of the spring plate according to the variation of the gap. These two objects, namely an exact positioning of

an adjusting element and the compensation of the force of a spring plate, have nothing to do with the above-mentioned object of the present invention, so that once more, the person skilled in the art would not have taken this document into account. Moreover, the construction described in this prior art, particularly in view of the spring plate, cannot suggest the construction according to Claim 7, which requires a spring coaxially ensheathing the slidable central rod.

11. Therefore, the board finds that the subject-matter of the independent Claims 1, 3 and 7 of the patent as granted is not obvious and thus involves the inventive step required by Article 52 combined with Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar: The Chairman:

N. Maslin C. T. Wilson