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**D E C I S I O N**  
**of 24. November 2005**

**Case Number:** T 0744/03 - 3.2.03

**Application Number:** 98910639.8

**Publication Number:** 0963492

**IPC:** E04B 5/00, E04B 5/43, E04C 5/01

**Language of the proceedings:** EN

**Title of invention:**  
Combination reinforcement for floor on piles

**Patentee:**  
N. V. BEKAERT S.A.

**Opponent:**  
TREFILARBED S.A.

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 123(2) and (3), 56

**Keyword:**  
"Amendments - deletion of range from description - broadening  
of claim - (no)"  
"Inventive step - (no)"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 0744/03 - 3.2.03

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.03  
of 24. November 2005

**Appellant:** N.V. BEKAERT S.A.  
(Proprietor of the patent) Bekaertstraat 2  
BE-8550 Zwevegem (BE)

**Representative:** Messely, Marc  
N.V. Bekaert S.A.  
Bekaertstraat 2  
BE-8550 Zwevegem (BE)

**Respondent:** TREFILARBED S.A.  
(Opponent) Route de Finsterthal  
LU-7703 Bissen (LU)

**Representative:** Ocvirk, Philippe  
Office Ernest T. Freylinger S.A.  
234, route d'Arlon  
B.P. 48  
LU-8001 Strassen (LU)

**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 4 July 2003  
revoking European patent No. 0963492 pursuant  
to Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** U. Krause  
**Members:** G. Ashley  
J.-P. Seitz

## Summary of Facts and Submissions

I. This appeal lies from the decision of the opposition division, posted on 04 July 2003, to revoke European patent 0 963 492 for lack of inventive step. The appellant (patentee) filed the appeal together with the appeal fee on 11 July 2003, and a statement setting out the grounds of appeal was received on 17 October 2003.

II. The patent in question concerns reinforced concrete flooring, and claim 1 of the granted patent reads as follows:

"1. A fixed construction (10) comprising rigid piles (12) and a monolithic reinforced concrete floor slab (14) resting on said piles (12), said rigid piles (12) being arranged in a regular rectangular pattern where each set of four piles (12) forms a rectangle, said floor slab comprising straight zones connecting in the two directions, i.e. lengthwise and broadwise, the shortest distance between those areas of the floor slab above the piles, **characterized in that** said floor slab is reinforced by a combination

- (a) fibres (22) being distributed over the volume of said floor slab (14),
- (b) steel bars (16) being located only in said straight zones."

Dependent claims 2 to 12 define preferred embodiments of the construction of claim 1.

III. The patent was opposed in its entirety, on the basis of Article 100(a) together with Article 56 EPC. The

respondent (opponent) had argued that the subject-matter of claim 1 lacks an inventive step, citing *inter alia* the following documents:

A1: X. Destrée, "Twincone S.F.R.C. Structural Concrete", published in "Fiber Reinforced Concrete - Modern Developments", edited by N. Bathia and S. Mindess, The University of British Columbia, Vancouver, Canada, 1995.

A2: S. Mindess, "Fibre Reinforced Concrete: Challenges and Prospects" published in "Fiber Reinforced Concrete - Modern Developments", edited by N. Bathia and S. Mindess, The University of British Columbia, Vancouver, Canada, 1995.

A6: FR-A-2 718 765

FR-A-1 105 259 (A9) was cited during the examination procedure; this document was seen by the Board as being relevant for the assessment of inventive step, and hence was admitted to the proceedings. In addition, the following Canadian standard was admitted as evidence of the general knowledge of the skilled person.

A10: CSA Standard A23.3-94 Design of Concrete Structures with Explanatory Notes, published by the Canadian Standards Association, Toronto, December 1994.

The request of the respondent to have further documents (A11 and A12) admitted into the proceedings was denied, since these documents did not appear to disclose

anything above and beyond what is known from the documents that are already in the proceedings.

IV. Requests

The appellant requests that the decision under appeal be set aside and the patent be maintained on the basis of granted claim 1, with the description amended to delete the sentence at page 2, lines 47 to 48 "The width of such zones ranges from 50% to 500% the largest dimension of the piles". As an auxiliary request, the appellant requests maintenance of the patent as granted.

The respondent requests that the appeal be dismissed.

V. Summary of the Arguments of the Parties

*Amendment to the Description: Article 123 EPC*

Claim 1 refers to straight zones, which connect the shortest distance between the areas of the floor slab above the piles. No dimensions for the zones are defined in the claim, but the description states that the width of the zones is between 50% to 500% the largest dimension of the piles.

The appellant argued that the range given in the description is much broader than one that would be understood by a skilled person reading claim 1 in the absence of the definition. The skilled person reading claim 1 alone would not realistically consider the width of the zones to be as much as five times the width of the piles. In addition, the lower limit given

for the width of the zone has no significance, since the claim itself only defines steel bars located within the zone. Since deletion of the range from the description means that no subject-matter is added and that the scope of protection is narrower, the requirements of Article 123(2) and (3) EPC are met.

The respondent was of the view that the expression "straight zones" was not clear, and the only indication of its meaning is the definition given in the description. Deletion of the range means that widths presently falling outside the defined range would now fall within the scope of the claim, contrary to Articles 123(2) and (3) EPC. In addition, deletion of the range means that there is no information concerning the dimensions of the straight zones; the scope of the claim would be uncertain and, for example, there would be doubt if widths such as 45% or 475% fall within the claim.

#### *Inventive Step*

The appellant considered A1, which discloses fibre-reinforced concrete floor slabs resting on piles, to be the closest prior art. The subject-matter of claim 1 differs in that the floor slabs also contain reinforcing steel bars, which are only located in the straight zones. It is clear that there must be reinforcement in the straight zones, as they are subject to high moments, but there is no indication in A1 that any further reinforcement is necessary beyond that provided by the fibres. Even if conventional reinforcement bars were to be added to the slabs of A1, there is no suggestion in the prior art to omit them

outside of the straight zones. The combination of fibre reinforcement with steel bars limited to the straight zones provides an alternative reinforcement that saves weight, and which is not obvious from the prior art disclosures.

In particular, A6 (page 4, lines 28 to 31) merely indicates that it is important to provide reinforcement in the straight zone, and that other zones require less reinforcement; there is no teaching to omit reinforcement altogether from the central zones. A2 is a very general document, which only vaguely teaches about possible combinations of fibre and conventional reinforcement and provides no indication that conventional reinforcement should be limited to the straight zones. In the list of uses for fibre-reinforced concrete given on page 2 of A2, there is no mention of floors on piles, so the subject-matter of the disputed patent is not even contemplated in A2; the document concludes that there is still much work to do, and gives no indication of the combination of reinforcement as defined in claim 1.

A10 is a norm dealing with conventional reinforcement, and it is doubtful whether it applies to fibre-reinforced concrete, which behaves structurally in a different manner. A2 at page 7 "Building Code Requirements" states that at that time (1995, which is just two years before the priority date of the disputed patent) there were no design codes for fibre-reinforced concrete. In any event, A10 concerns reinforcement in the zones above the piles, and does not exclude reinforcement in the central zones.

In conclusion, there is no hint in the prior art to omit reinforcing bars outside of the straight zones, and thus the flooring defined in claim 1 has an inventive step.

The respondent agreed that A1 is the closest prior art, with the difference being the presence of steel bars in the straight zones. The problem to be solved, as set out in the disputed patent is how to provide an alternative reinforcement, whilst saving weight.

It is well known in the art that the straight zones require extra reinforcement, examples of this are shown in A6 (page 4) and A9 (page 1, lines 6 to 10). In addition, the combined use of fibres and reinforcement bars is known from A2; this document teaches that fibres should not normally be used on their own, but should be supplemented by conventional steel reinforcement. A10 is a Canadian norm, and thus illustrates the general technical knowledge of the skilled person; it discloses that the minimum reinforcement for such flooring requires steel bars (at least two) in the straight zones. The term "minimum" implies that more steel bar reinforcement may be added, but only if necessary i.e. steel bars can be omitted outside the straight zones if not required. Given that A1 and A2 are Canadian documents and A10 is a Canadian standard, it would be reasonable to assume that the standard would be applied to flooring produced in accordance with A1 and A2. Therefore, considering that the problem underlying the invention is to improve strength whilst saving weight, no inventive step can be recognised in the provision of reinforcement bars only in the straight zones.



## Reasons for the Decision

1. The appeal is admissible.

### Main Request

#### *Amendment to the Description: Article 123 EPC*

2. Claim 1 states that the "floor slab comprises straight zones connecting in the two directions, i.e. lengthwise and broadwise, the shortest distance between those areas of the floor slab above the piles". There is no reference in the claim to the width of the zones, but the description at page 2, lines 47 to 48 defines the width as "ranging from 50% to 500% the largest dimension of the pile", and it is this feature that the appellant seeks to delete.

Claim 1 of the granted patent corresponds to claim 1 of the application as originally filed. It is clear that deletion of the range in the description is in accordance with Article 123(2) EPC, since the embodiment defined in claim 1 itself makes no mention of the range. Rather, the question is whether the amendment results in a broadening of the scope of the claim contrary to Article 123(3) EPC.

It is first necessary to consider what the skilled person, having knowledge of the range given in the description, would understand by the definition of the straight zone in claim 1. The width of the zone is defined in the description with respect to the largest

dimension of the piles. Strictly speaking, the largest dimension of a pile would be its length, but even taking the largest dimension to be width of the pile, as probably intended by the patentee, a width that is five times the pile width would give an upper limit that extends beyond the line of the piles towards the centre of the floor slabs. The lower limit, as indicated by the appellant, has little meaning, since the claim only defines steel bars located in the zone; so to take an extreme value in which only one steel bar is present, the zone is the width of a steel bar.

Leaving aside the range defined in the description, the wording of the claim alone defines the straight zone as that which connects the shortest distance between the areas above the piles. This definition is by itself clear to the skilled person, who would understand the areas to be those directly above the piles. There is no indication either in the claim or in the description to read further meanings into the definition, such as "above and to the side of the piles", particularly as it is well known that the purpose of the steel bars in this zone is to reinforce the parts of the floor slab that connect the piles (see the discussion on inventive step, below). Consequently, reading the claim on its own provides a narrower definition of the straight zones than if the range given in the description is applied. Since a claim is to be construed in light of the description, removal of the range leads to a narrowing of the scope of claim 1 within the meaning of Article 123(3) EPC.

*Novelty*

3. Novelty of the claimed invention has not been questioned, and indeed, the combination of features defined in claim 1 is not disclosed in any of the available prior art documents.

*Inventive Step*

4. The patent relates to industrial floors comprising reinforced concrete floor slabs resting on rigid piles. The opposition division and both parties regard A1 as being the closest prior art, and there is no reason to depart from this view. A1 is an academic paper discussing the uses of fibre-reinforced concrete, and in particular its application for so-called "mushroom-floors", which comprise monolithic slabs resting on piles that are located with a grid spacing of 3.5 to 5 metres in each direction (see page 79), i.e. the rigid piles are arranged in a rectangular pattern and each set of four piles forms a rectangle.

The subject-matter of claim 1 differs from that of A1 in that steel bars are provided as additional reinforcement, and are located only in the straight zones.

It is apparent that the strengthening mechanisms of steel bars and fibres are different. A2 (page 5) explains that steel bars withstand tensile, shear and compressive loads better than fibres, whereas the main function of fibres is to control matrix cracking. Although the appellant argues that there is no indication in A1 that concrete flooring strengthened

only by fibres is inadequate, the objective problem to be solved starting from A1, can nevertheless be seen as how to increase further the strength of the flooring, particularly given the limited strengthening mechanism of fibre reinforcement mentioned previously.

It is well known that in flooring resting on piles the straight zones between the piles are subject to high loads requiring appropriate reinforcement, and indeed this was not contested by the appellant. A10, which is a Canadian standard for concrete flooring and as such is indicative of general knowledge in the art, sets a minimum amount of reinforcement that must be provided in this area (see 13.11.5.2); document A9 (see Figures 6, 7 and 9) is directed to the reinforcement of the straight zones areas; both document A6 (see page 4, lines 22 to 31) and the patent itself refer to the high moments created in the areas above the piles when the floor slab is under load (see page 2 of the description, lines 19 to 21). It is thus apparent to the skilled person using his general knowledge that in order to increase the strength of the flooring of A1, extra reinforcement must be provided in the straight zones. The question then to be answered is how should this reinforcement be applied.

Given that the flooring of A1 is reinforced with fibres, one approach would be to increase the amount of fibres. In practice it is not straight forward to increase the amount of fibres only in one part of a concrete slab, so the simplest step would be to increase the fibre content as a whole. However, as stated in the introduction to the disputed patent (see page 2, lines 22 to 24), such a step would not be economical, since

in doing so the zones between the piles would have a quantity of steel fibres that is unnecessarily too high, and which would cause trouble during the pumping and pouring of the concrete. In addition, as mentioned above, fibres may not provided the appropriate strengthening mechanism for the straight zones. The skilled person would therefore not consider merely increasing the fibre content.

A2 discloses concrete having both fibre and conventional steel bar reinforcement. Although the appellant argues that there is no explicit mention of concrete flooring on piles in the list on page 2 of A2 ("Current Practice in the Use of FRC"), it is stated that fibre-reinforced concrete is used for industrial floors (see page 2, point 2). In addition, both A1 and A2 are papers published in the same book (the proceedings of a workshop discussing developments in fibre reinforced concrete). It is thus considered that the skilled person would have no difficulty in combining the disclosures of these documents. A2 teaches (see page 5) that fibres cannot in general be used simply to replace conventional steel reinforcement, but steel bars are placed at specific locations in structural members to withstand tensile, shear or compressive loads; this is because of the different strengthening mechanisms associated with fibre reinforcement. The skilled person thus knows that in order to improve the fibre-reinforced flooring of A1, he should supplement it with conventional steel reinforcing bars, and that these should be placed at specific locations. Such specific locations must comprise the straight zones, but the appellant argues that the skilled person would incorporate the

conventional reinforcement throughout the slabs, since there is no suggestion in the prior art that it can be omitted from outside the zones. The Board, however, does not agree with this argument, since it is an aim of the patent (see paragraph [0007]) to provide reinforced concrete flooring, which saves weight of steel. The skilled person knows from his general knowledge, as evidenced by A9, A10 and A6, that higher stresses are present in the straight zones between the piles compared with those in the centre, and hence extra reinforcement is not required in the central zones; A9 and A10 also show that reinforcement need only be applied to the straight zones. Being mindful of the need to save weight and money, it is normal practice to avoid including reinforcement in regions where it is not necessary. The skilled person would thus avoid applying the extra reinforcement in the central zones, and restrict it to those areas which are subject to higher stresses, i.e. the straight zones between the piles.

The subject-matter of claim 1 therefore lacks an inventive step in light of A1 combined with A2 and the general knowledge of the skilled person.

#### Auxiliary Request

5. According to the definition given in claim 1 of the auxiliary request, the zones containing steel bar reinforcement may be interpreted as being so broad that they encompass not only the shortest distance between the areas above the piles, but also areas to the sides of the piles (see paragraph 2 above). The scope of this claim is thus broader than that of claim 1 of the main

request. However, the placing of steel bars in the straight zones as understood in the narrow sense of the main request is not excluded by the definition given in claim 1 of the auxiliary request. This claim thus lacks an inventive step for the same reasons as given in respect of claim 1 of the main request.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

R. Schumacher

U. Krause