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File No.: T 0605/91 - 3.2.3  
Application No.: 85 830 155.9  
Publication No.: 0 170 631  
Classification: E01B 1/00, E01B 3/40  
Title of invention: Components for railway lines on pre-fabricated  
reinforced concrete slabs without ballast

**D E C I S I O N**  
of 20 July 1993

Applicant:

Proprietor of the patent: I.P.A. S.P.A. - INDUSTRIA PREFABRICATI AFFINI

Opponent: Allgemeine Baugesellschaft A. PORR AG

Headword: Railroad line bed/INDUSTRIA PREFABRICATI

**EPC:** Art. 56

Keyword: "Inventive step (no)" - "Functional inversion" - "Long felt want  
(no)"

**Headnote**  
**Catchwords**



Case Number: T 0605/91 - 3.2.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.3  
of 20 July 1993

**Appellant:** Allgemeine Baugesellschaft A. PORR AG  
(Opponent)

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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office dated 3 June 1991 rejecting  
the opposition filed against European patent  
No. 0 170 631 pursuant to Article 102(2) EPC.

**Composition of the Board:**

**Chairman:** C.T. Wilson  
**Members:** K.W. Stamm  
L. Mancini

**Summary of Facts and Submissions**

I. European patent No. 0 170 631 was granted on 12 April 1989 with five claims in response to the European patent application No. 85 830 155.9 filed on 20 June 1985.

II. Granted Claim 1 reads:

"1. A ballastless railroad line bed comprising an elongated steel-reinforced concrete support block (1), formed with spaced apart upwardly-open cylindrical seats (7), and supporting a plurality of rectangular pre-fabricated reinforced concrete slabs (2), spaced along said block and having confronting edges along each of which there is provided an integral downwardly projecting semi cylindrical protuberance, each of said cylindrical seats receiving respective semi cylindrical protuberances of successive slabs along said bed, said slabs and said support block defining spaces between them at least along the entire underside of said slabs, said spaces being substantially filled by respective layers of a yieldable concrete asphalt mortar (6) injected thereinto."

III. A Notice of Opposition was filed against the European patent on 10 January 1990 requesting revocation of the patent having regard to Articles 52(2), 54, 56 and 123(2) EPC. The following documents were cited:

- D1: US-A-3 382 815
- D2: DE-A-1 922 055
- D3: DE-B-2 354 958
- D4: DE-B-2 126 158
- D5: DE-B-2 425 599.

- IV. In its decision of 3 June 1991, issued on 13 June 1991, the Opposition Division rejected the opposition since the subject-matter of Claim 1 was patentable.
- V. The Appellant filed a Notice of Appeal by telecopy on 12 August 1991 (confirmed by letter received on 16 August 1991) and paid the appeal fee on 12 August 1991. The Statement of Grounds was received on 7 October 1991. Attached to a letter of the Appellant, dated 28 June 1993, the following document was received:

D6: Josef Eisenmann: "Stand und Weiterentwicklung der Eisenbahntechnik in Japan", Zeitschrift Eisenbahningenieur 30 (1979) 6, pages 261 to 269.

The Appellant's (Opponent) view is summarised as follows:

- (a) The primary problem to be solved by the invention was to reduce the gap between two slabs in order to diminish the effects of weather conditions as regards the asphalt mortar in that gap. A quantitative comparison with document D1 would, however, show a minor improvement of about 25% only.
- (b) The further problem to improve the transfer of forces between the slabs and the support block was not solved. The embodiment according to document D1 was fully equivalent to the claimed subject-matter. The distinction was determined only by the difference between the effective surface of 475 cm<sup>2</sup> and the total surface of 4560 cm<sup>2</sup>.
- (c) The still further problem to facilitate repair of the projections after rupture was not posed in practice; the solution of a fictional problem could

not justify an inventive activity in respect of an aggregation.

- (d) Reference was made to the development of ballastless structures of the Japanese national railways.
- (e) The invention was deducible from D1 by providing semicylindrical projections instead of semicircular openings; the resultant changes of the properties was not sufficient reason to recognise an inventive step.

VI. The view of the Respondent expressed in his letter, dated 31 January 1992, is summarised as follows:

- (a) The calculations made by the Appellant were completely wrong. In the solution according to the invention the cement-asphalt mortar being subjected to stress (the mortar which surrounds the stopper) was never exposed, at any point, to deterioration caused by weather etc. since it was constantly protected by a layer above the stress contact zone.
- (b) The Japanese railroad service found that the stoppers tend to break up.
- (c) The stoppers according to the invention were manufactured with the same pre-stressed material (prefabricated concrete) with which the slabs were manufactured. The stoppers in D1, however, had to be produced on site with concrete cast in place. Therefore, the stoppers according to the invention were 50% stronger than the material in D1.
- (d) The inventive solution provided for a further important advantage, since the slabs allow

longitudinal and transversal pre-stress; D1 had semicircular recesses which prevented transversal pre-stress of the slabs in this region.

- (e) The contested invention could not be regarded as a simple kinematic inversion of the D1 solution. If the D1 system was inverted and thus the cylinder protruded downwardly, there was still the problem of having to divide each cylinder into two parts. But even if such arrangement was suggested, one would still not obtain the claimed solution but a solution, where the distance between the surface of the two half-cylinders and the perimetric surface of the seat in which they were accommodated was not constant.

In order to obtain the contested solution, it was not sufficient to divide a cylinder of D1 in two after inverting it, but it was necessary to remove therefrom a slice of material from its central portion.

- (f) Having two stoppers for each slab offered a greater security of resistance to stresses with respect to a single stopper for each plate as in D1.
- (g) The following advantages of the invention were mentioned in particular:

- It is possible to protect the lower layer of the cement-asphalt around the stopper.
- If this layer is also cement-asphalt, it is possible to check periodically the possible breaking up of the surface. Maintenance is possible without stopping the train traffic. The

stoppers still completely ensure the stress resistance.

- If the layer in D1 is subjected to maintenance, the surface of the stopper works only partially, no longer ensuring the stress resistance for which the line has been designed and forcing the stopping of train traffic.

VII. In the oral proceedings on 20 July 1993 German was used according to Rule 2(4) EPC. The Appellant referred in particular to the following arguments:

- (a1) Document D1 showed mutually cooperating cylindrical projections and semicylindrical openings for transferring the horizontal forces. According to the contested patent the positions of projection and opening were exchanged in analogy to kinematic inversion. This would have necessitated an inventive step only if the skilled person had been hindered by prejudice from providing upper pins and lower openings. However, document D2 showed such a construction already. In D1 reference sign 9 (Figure 3) showed likewise downwardly directed projections. Thus, no prejudice against downwardly directed projections had existed.
- (a2) As regards the unexpected advantages alleged by the Respondent it was to be stated that a higher strength of concrete was not necessarily given by prefabrication alone; a multitude of factors was relevant, as for example the chosen reinforcement, the water-cement-ratio and the cement quality.
- (a3) If one nevertheless assumed that prefabricated concrete achieved a compressive strength of double value compared with concrete cast *in situ*, the

following situation would be given: According to the contested patent horizontal forces having double the strength act on the semi-cylinder. In D1 forces having half this strength act on the whole cylinder. The result would therefore be the same.

- (a4) Also in accordance with the contested patent the transverse gap would be exposed to weather conditions such as to achieve no relevant improvement in comparison with D1.
- (a5) It was also not justified to assume that the pins in D1 would break. The results of rupture of a pin according to the contested patent were even more inconvenient than the ones in D1. Such a broken pin necessitated complicated measures and finally the exchange of a whole slab-element whereas according to D1 a pin alone could be removed and replaced.
- (a6) Not only the pin was engaged in the transfer of the forces but also the front surface; this was evidenced by photographs (presented during oral proceedings).
- (a7) Not one of the assumed effects had been unexpected for the skilled person.

The Respondent was of the following view:

- (b1) The considerations of the Appellant were possible only ex post. The projections 9 in D1 could not be compared with those of the patent in question since they were components of the support.
- (b2) Prefabrication achieved higher concrete strength than cast in situ concrete.

- (b3) Both projections according to the contested patent were participating in the transfer of horizontal shear in a proportion of about  $2/3$  to  $1/3$ . The rupture of one of the cylinders in D1 would result in a horizontal deviation based upon double the length than resulted upon rupture of a projection of the contested patent.
- (b4) One could only refer to a kinematic inversion, if the same conditions were achieved as by D1. However, the contested patent relates to a wholly different system in which the forces have completely different and unforeseen effects. Therefore, the term "kinematic inversion" was not appropriate and the claimed solution was not obvious.
- (b5) D2 dealt with the transfer of the forces in the layer of mortar between the support and the slab. As regards the projection, mentioned on page 2 in the comment on Figure 2, any exact information concerning position, form and function was missing. D2 was, therefore, not able to suggest the skilled person to provide the claimed projections on the ends of the slab in D1 instead of the semicylindrical openings. Since the forces in D2 were taken up by an interface also no relation existed to the "counterbalance of forces", which also belongs to the problem to be solved. The projection could transfer only transverse forces and was not therefore suitable to improve D1, which also transferred longitudinal forces.
- (b6) The solution according to D1 was implemented in 1975 in Japan; one year later already damage was observed. The projections had hindered work on site, as evidenced by the photographs presented

during oral proceedings showing especial bridging constructions for the lorries.

(b7) However quite different solutions would have been obvious, as, for example, the use of prefabricated cylindrical pins to be mounted into openings provided on site. Also a partial covering of the pins by means of accordingly formed flanges on the opposite side faces of the transverse gaps would have formed part of the normal considerations of the skilled person. An inversion, however, had never been considered and was only deducible in a retrospective manner.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent requested that the appeal be dismissed and that the patent be maintained.

### Reasons for the Decision

1. The Appeal is allowable.

2. *Novelty*

In the view of the Board novelty of the subject-matter of Claim 1 is legitimately not contested by the Appellant.

3. *Prior art, technical problem and solution*

3.1 Document D1 shows a ballastless railroad line bed having a concrete foundation and prefabricated concrete slabs. The foundation carries upwardly arranged cylindrical

projections; the slabs are provided with semi-circular seats adapted to be fixed by the projections.

The contested Claim 1 defines a similar construction having a reinforced concrete foundation and prefabricated reinforced concrete slabs. The foundation carries downwardly arranged cylindrical seats, the slabs are provided with semi-circular projections adapted to be fixed by the seats.

The subject-matter of Claim 1 is distinguished from the construction described in D1 as follows:

- (1) The slabs are provided with the projections; the foundation is provided with the seats.
- (2) The cross-sections of the projections are semi-circular; the cross-sections of the seats are cylindrical.

3.2 The problem to be solved is - as expressed in the description of the invention - to provide components for ballastless railroad lines laid on concrete slabs which can combine, with a highly stable alignment both in the vertical and horizontal directions, the possibility of reducing maintenance requirements and which can afford reduced deterioration.

3.3 Claim 1 suggests a prefabricated construction allowing better mechanical qualities of the cylindrical projections. The protection of the contact gap around the cylindrical surfaces is considerably improved since they are covered by the slabs themselves and, thus, are not exposed to direct weather conditions. This construction involves several further advantages over the prior art - the solution of the problem is achieved.

4. *Inventive step*

- 4.1 In document D1 a special construction was suggested as a bearing for the horizontal forces: a cylindrical concrete projection of the base takes up the forces transferred by semi-circular holes at the front section of adjoining prefabricated slabs. D1 taught, therefore, to use a special modification of the "pin and hole" connection as a horizontal bearing.

The skilled person would have found the pin and hole connection of D1 in its functional behaviour principally as appropriate, but would have had doubts, however, as regards the protection of the semi-circular gaps (Figure 2) and as regards the projections forming obstacles for the mounting of the prefabricated slabs. This (projections as obstacles) was confirmed during oral proceedings, where photos presented by the Applicant showed special transverse and longitudinal wooden constructions necessitated for lifting of the lorries (cf. above under point VII(b6)) to a higher level.

It cannot be doubted that the skilled person, whenever having to use a bearing in the form of cooperating "pin and hole", is necessarily confronted with the question where to place the pin and where to place the hole - since the principal action thereof is independent of their relative position. Therefore such static independence of the relative position of the two cooperating elements involves their mutual functional reversibility. In view of the prior art document D1 a functional inversion of seat and projection appears, consequently, as a self-evident basic variant.

Therefore, the skilled person who immediately understands that the above disadvantages are caused by

the order of the relative vertical position of pin and hole in D1 will find that easy remedy is to be achieved by the inversion of that order. Upper pins and lower holes would remove the obstacles and would cover, and thus protect, said gaps.

4.2 The idea of such a functional inversion was not only general knowledge but also known in the relevant field. In Document D2 an upper projection of a slab is shown, the projection entering in a lower hole, both of rectangular cross-section. This solution allows transfer of transversal horizontal forces only. The skilled person is aware, however, in comparison with the exposed gap of D1, that the slab covers the gap transferring the horizontal forces. This document appears, therefore, to teach directly that lower seats are favourably closed when using upper projections - confirming the findings of the skilled person as explained above under point 4.1.

4.3 Such an advantageous functional inversion (of the relative vertical position) would not, however, be immediately applicable if the respective cross-sections were inverted also: a circular projection of the slab would not match with a semi-circular seat in the basis. The skilled person was, therefore, inevitably obliged to look for appropriate cross-sections. **Choice of appropriate cross-sections is a general fundamental step in the design of concrete structures.** Even D1 follows this triviality explicitly: "The projection 6b may be cylindrical or of any other suitable section" (column 2, lines 24 and 25).

Thus, the skilled person would certainly not overlook that the semi-circle of the upper seats forms a cross-section appropriate also for the searched upper projection and likewise that the lower circle of the

projections in D1 is well appropriate for the cross-section of the searched lower seats. Such a construction appears as closest to the one in D1 since it results from it as a **minimal modification** having **maximal similarity** when the mentioned functional inversion is to be realized. The skilled person will find such a construction, therefore, in the direction of normal design activity related to prefabricated slabs and closest to the known one according to D1.

This obvious construction is, however, the one defined in Claim 1. (The term "steel reinforced (concrete)" not expressly mentioned in D1 is empirically self-evident for the shown concrete slabs and thus to be regarded as factually implied).

4.4 Since in the preceding argumentations the claimed solution appears merely as a problem-inferred inversion of known functional elements, the danger of an inadmissible **ex post view** - alleged also by the Respondent - requires additional tests. In this respect the following is to be considered:

4.4.1 D1 was patented in 1968, i.e. sixteen years before the priority date (1984) of the patent under appeal. The Respondent is of the view that this fact confirms also the existence of a "long felt want" and thus the necessity of an inventive step for finding the claimed subject matter under appeal (cf. above under points VI(e) and VII(b6)).

The time elapsed between D1 and the presently claimed subject-matter is, however not sufficient to prove the assumed "long felt want". It is not sufficient if only one individual skilled person discovers such a "want". Only if various and repeated attempts could be identified which would have dealt with the disadvantages

of the construction according to D1, would such a "want" appear to have persisted. This is not the case.

Also the essay D6 is not sufficient to infer from it the existence of a long felt want. On the contrary, the passage on page 268, left column, lines 8 to 14 with reference to Figure 4, cited by both parties, confirms the principal reliability of the construction. The Respondents' contention that damages had been already known one year after completion is not substantiated and is in direct contrast to D6.

Therefore, the time of sixteen years between the grant of D1 and the priority date of the present patent does not yet indicate general, repeated and unsuccessful attempts at solving the problems related to D1 during that time. In particular this time cannot prove the existence of unsurmountable prejudices which would have hindered the skilled person to find obvious solutions of the appropriate problems.

- 4.4.2 The Appellant also assumes that static and deformation effects of the contested solution would prove a far-reaching technical distinction between the subject-matter of Claim 1 and the known solution in D1 - a distinction which, in his view, would not allow to understand this solution as simple kinematic inversion only (cf. above point VI(e)).

The Board considers the term "**kinematic inversion**" in the present case as rather misleading, but also the alleged importance of the technical differences as questionable. The present inversion is not exactly equivalent to the relative movability and immovability of two elements (as assumed by the term kinematic inversion). It is rather the spatial relationship of two structural elements which are defined by their relative

functions which is inverted. There is, however a clear analogy since in both cases the inversion of a spatial order is decisive. In the present case in particular a functional inversion appears to be fundamental. This inversion follows, as reasoned above, as a consequence of the understanding of the cause of recognisable disadvantages of the construction disclosed in D1 together with an attempt to modify that construction in the least possible way.

The technically diverging distinctions achieved by the claimed solution (e.g. the different distribution of forces and participation of one or two bearings, respectively slabs) appear in general to be rightly alleged as such by the Appellant. Since they are - even unexpected - **consequences** of an already obvious solution, they cannot, however, be considered again as a **cause** for the solution. The deviating effects cannot, therefore, influence the obviousness of the found principle of the solution, viz.: inversion of the functions pin and hole without inversion of the relative cross-sections.

4.5 Summarising, it has been found that the person skilled in the art attempting to solve the objective problem as set out in point 3.2 above with respect to the construction of D1 would have been led to make a routine functional inversion of the pin and hole together with a consequential routine choice of disclosed appropriate cross-sections.

Therefore, the subject-matter of Claim 1 is to be considered as obvious to the person skilled in the art. It is not patentable having regard to Articles 52(1) and 56 (EPC). Without a valid Claim 1, the dependent Claims 2 to 5 also have no validity.

**Order**

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

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:



N. Maslin

The Chairman:



C.T. Wilson

See 14.9.93

Sum