

Dowel Strip for Bent-Up Bars

The invention pertains to a dowel strip for bent-up bars in reinforced concrete beams or panels, consisting of a strip and a plurality of dowels perpendicularly welded to the strip at one of their ends and spaced apart, each having a dowel shank and, on their ends facing away from the strip, a dowel head that is wider than the dowel shank.

Known dowel strips of this kind (DE-PS 27 27 159.6) serve to form bent-up bars in reinforced concrete beams and panels at points of support, particularly in the vicinity of column connections, to absorb the lateral forces occurring in these areas due to stress created by the vertical columns.

In a reinforced concrete beam or concrete panel reinforced in this fashion, a grid is formed in the column area that may be described using the model of a truss, the truss members of which are referred to with the terms customarily used for trusses.

Longitudinal reinforcement bars on the topside of the beam or panel form a tension chord member in the area of the columns. The dowels of the dowel strip located perpendicular to these tension chord members represent the vertical tension members of the truss. The concrete that is in compression on the underside of the beam or the panel in the vicinity of the columns, assumes the function of the compression chord member; this function may also be assumed by the dowel strips if these extend in the longitudinal direction of the beams. Between the dowel heads on top and the points of support of the column or the dowel strips of adjacent additional dowels, sloped struts are formed in the concrete of the truss used as a model.



The formation of a truss framework joint at the dowel head or strip, respectively, requires that the vertical tension member force is transferred all the way to the dowel head or strip, respectively, so that the differential forces can be transferred to the tension chord member or the compression chord member, respectively through a positive enclosure by the concrete.

In the known dowel strips, the dowel shank is designed smooth and cylindrical; the resulting relatively minor adhesion between the dowel shank and the concrete results in the force of the vertical tension member being transferred until it reaches the dowel head or dowel strip, respectively.

The sloped main tensile stress forming in the concrete leads to the formation of shearing cracks in the concrete extending approximately in the direction of the sloped struts, whereby their width restricts the load carrying capacity of the beam or panel.

According to a known process, the width of unavoidable shearing cracks in the concrete is limited and the carrying capacity of the structural component increased by inserting additional bent-up bars essentially extending perpendicular to the expected direction of the cracks.

In a beam or panel equipped with dowel strips serving as bent-up bars, according to this theory either the bent-up bars consisting of dowel strips would be reinforced by using more or larger diameter dowels, or a separate, additional bent-up bar would be inserted to limit the width of the cracks. Both measures, however, involve additional material and labor costs.



The aim of the invention is therefore to design a dowel strip of the above type to effectively limit the width of the cracks in the concrete without additional material or labor expenditures while maintaining the effective formation of truss framework joints at the dowel heads.

This aim is attained according to the invention with a dowel shank having a smooth, cylindrical shape at its two shank end sections and a shank center section with a ribbed surface located in between.

The transmission of the force of the vertical tension member required for the formation of a truss framework joint at the two ends of each dowel is sustained based on the two shank end sections adjacent to the dowel ends being smooth and therefore attaining only a very minor adhesion with the surrounding concrete. The shank center section, which preferably consists of ribbed reinforcement bar, provides for the desired good adhesion between the dowel and the surrounding concrete with its ribbed surface located between the two smooth shank end sections. This adhesion limits the width of the shearing cracks forming along the sloped struts. The result is an increased load carrying capacity of the beam or panel reinforced in this fashion without the need for any additional reinforcement.

The dowel shank may be manufactured from ribbed reinforcement bar, the ribs of which are smoothed at the two shank end sections. It is also possible instead, to have a shank center section made of ribbed reinforcement bar welded to the two shank end sections made of smooth rod-steel.



The length of the ribbed shank center section essentially depends on the height in which the shearing cracks that need to be limited are expected to occur in the concrete. This may be determined in the individual situation from the location of the forming sloped struts that may be determined according to the above truss model for each individual application.

Advantageous designs of the idea of the invention are the subject of additional sub-claims.

An example design of the invention shown in the drawing is explained in more detail below. The drawings show the figures as follows:

Fig. 1 a simplified partial longitudinal section through a beam at the point of support of a column,

Fig. 2 a sectional view along line II-II of Fig. 1, and

Fig. 3 an enlarged partial view and a section of one of the dowel strips serving as bent-up bars in the example according to Fig. 1 and 2.

The reinforced concrete beam 1 shown in Fig. 1 is supported by a column 2. Horizontal reinforcement bars 3 consisting of ribbed reinforcement bar have been inserted on the topside of the beam 1 as reinforcement for the tension chord member.

Several dowel strips 4 have been inserted as bent-up bars in beam 1 in the vicinity of column 2. In the depicted example design, these consist of a bottom strip 5 extending in a direction perpendicular to the longitudinal direction of the beam and have a vertical dowel 6 perpendicularly attached at both ends.

As shown in a detailed view in Fig. 3, each dowel 6 has a dowel shank 7 welded onto the strip 5 with its lower end. At its upper end the dowel shank 7 is connected to a widened, plate-shaped dowel head 8 preferably designed with a flat, truncated shape on its side facing the dowel shank 7.

At its two shank end sections 7a and 7b, facing the dowel head 8 and the strip 5, respectively, the dowel shank 7 has a smooth, cylindrical shape. A shank center section 7c located in between is made of ribbed reinforcement bar and has ribs 9 on its surface.

The length a or c of one or both shank end sections 7a or 7b corresponds, for example, to 1 to 2 times the diameter d of the dowel head 8. In the shown example, the length a or c of one or both shank end sections 7a or 7b corresponds to 1/4 to 1/10 of the length L of the dowel shank 7.

In the shown example the dowel shank 7 is made of ribbed reinforcement bar, the ribs 9 of which are smoothed on the two shank end sections 7a and 7c. It is also possible instead, to manufacture the shank center section 7b of ribbed reinforcement bar and weld it to the two shank end sections 7a and 7c made of smooth rod-steel.

In a deviation from the shown example design, the shank end sections 7a and 7c may also be larger in diameter than the shank center section 7b.

As shown in a simplified form in Fig. 1, struts 10 form inside beam 1 due to the force transmitted by column 2, whereby these struts 10 extend upwards to the dowel heads 8 of the dowel strips 4.

A horizontal compression chord member 11 forms in the concrete at the underside of the beam 1.

The upper tension chord member 3, the bottom compression chord member 11, the sloped struts 10 and the dowels 6 as vertical tension members form a truss inside beam 1. The sloped struts 10 extend from the dowel heads 8 not only to the point of support of column 2, but partially also to the strips 5 at the lower ends of the dowels 6.

This results in the formation of truss framework joints at the dowel heads 8 and the strips 5. Since the shank end sections 7a and 7c of the dowels 6 do not provide any significant adhesion with the surrounding concrete because of their smooth exterior, the insertion of the beam force at the dowel ends takes place almost exclusively through the positive splice of the dowel heads 8 or the strips 5, respectively.

Shearing cracks 12 form in the concrete along the struts 10, as indicated in Fig. 1. It is apparent that these shearing cracks 12 cross the dowels 6 of the dowel strips 4 mainly in the vicinity of the shank center sections 7b. In this area the ribs 9 create a good adhesion between the dowel shank 7 and the surrounding concrete. This adhesion between the concrete and the reinforcement counteracts a widening of the shearing cracks 12 and thus effectively limits the width of the cracks.



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REPLACED

Dowel Strip for Bent-Up Bars

Patent Claims

1. Dowel strip for bent-up bars in reinforced concrete beams (1) or panels, consisting of a strip (5) and a plurality of dowels (6) perpendicularly welded to the strip at one of their ends and spaced apart, each having a dowel shank (7) and, on their ends facing away from the strip (5), a dowel head (8) that is wider than the dowel shank (7), characterized in that the dowel shank (7) has a smooth cylindrical shape at its two shank end sections (7a, 7c) and that a shank center section 7b located in between has ribs (9) on its surface.
2. Dowel strip according to claim 1, characterized in that the shank center section (7b) consists of ribbed reinforcement bar.
3. Dowel strip according to claim 2, characterized in that the dowel shank (7) is made from ribbed reinforcement bar, the ribs of which are smoothed at the two shank end sections (7a, 7c).
4. Dowel strip according to claim 2, characterized in that the shank center section (7b) is made from ribbed reinforcement bar and welded onto the two shank end sections (7a, 7c) consisting of smooth rod-bar.
5. Dowel strip according to claim 1, characterized in that the length (a or c, respectively) of one or both shank end sections (7a or 7c, respectively) corresponds to 1 to 2 times the diameter (d) of the dowel head (8).

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6. Dowel strip according to claim 1, characterized in that the length $\underline{a}$ or $\underline{c}$, respectively, of one or both shank end sections (7a or 7c) corresponds to $1/4$ or $1/10$ of the length $\underline{L}$ of the dowel shank (7).

7. Dowel strip according to claim 1, characterized in that the shank end sections (7a, 7c) are larger in diameter than the shank center section (7b).

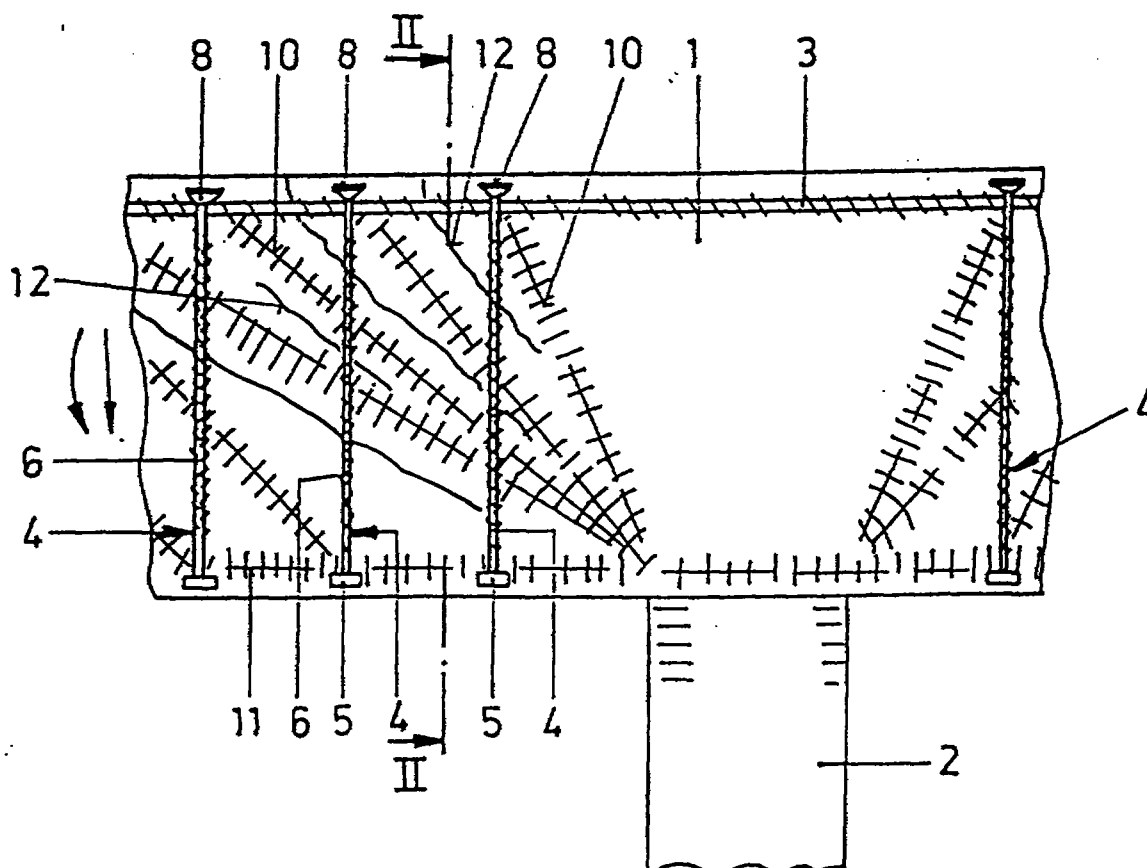


FIG. 1

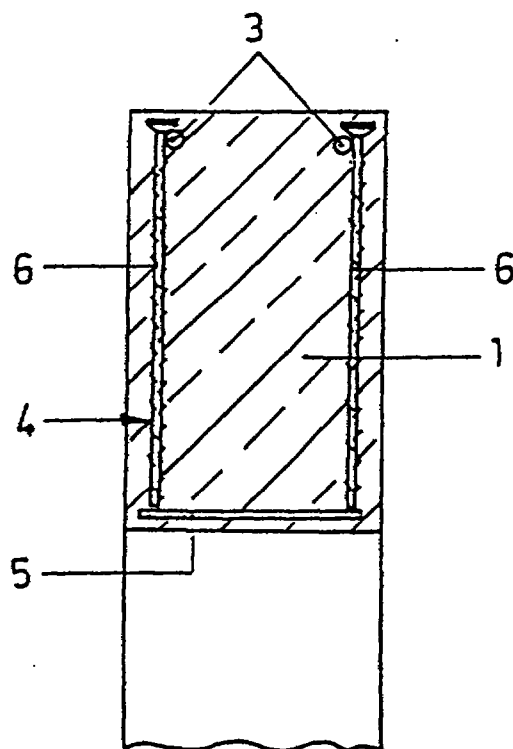
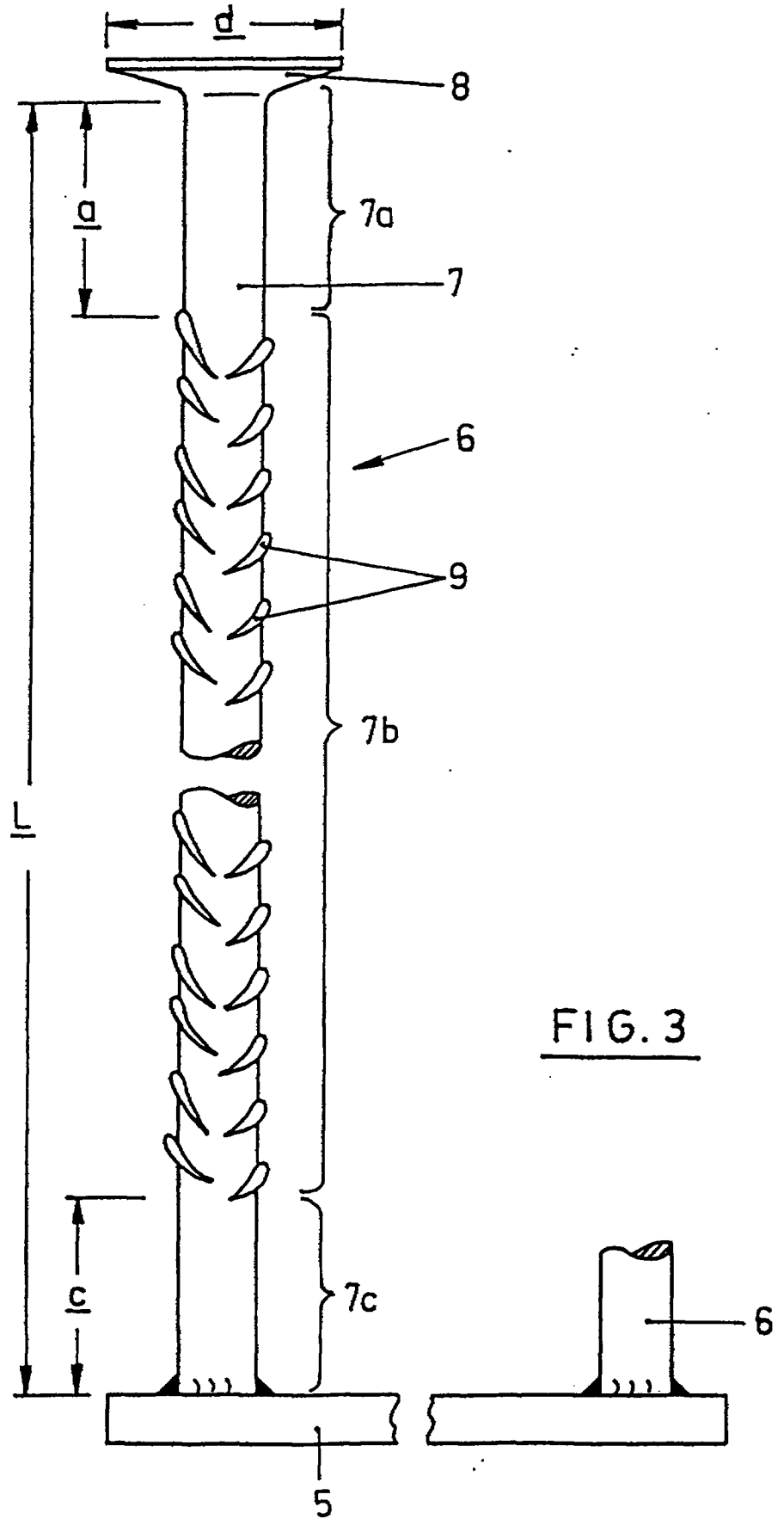


FIG. 2



**DECLARATION IN SUPPORT OF VERIFIED
TRANSLATION OF ANNEX TO INTERNATIONAL PRELIMINARY
EXAMINATION UNDER PCT ARTICLE 36**

Subject: International Application No. PCT/EP95/00891
"Dowel Strip for Bent-up Bars"

I, Marc Masurovsky, certify that I am familiar with both the German and the English language, that I have prepared the English translation attached hereto from the German language of the Annexes to the International Preliminary Examination Report of International PCT/EP95/00891, and that the English translation is a true, faithful and exact translation of the corresponding German language document also attached hereto.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereto.

By Marc Masurovsky

Annexes
to IPR

SG 9611701-5.

V. Assessment pursuant to Article 35 (2) regarding novelty, inventive activity and commercial applicability; documentation and explanations supporting this assessment

1. ASSESSMENT

Novelty	Claims 1 - 7 _____	YES
	Claims _____	NO
Inventive Activity	Claims 1 - 7 _____	YES
	Claims _____	NO
Commercial Applicability	Claims 1 - 7 _____	YES
	Claims _____	NO

2. DOCUMENTATION AND EXPLANATIONS

1.) The closest prior art is contained in EP - A - 495 334.

The aim of the invention is to design a dowel strip of the known type so that an effective formation of truss framework joints is attained at the dowel heads and the strips, and the width of cracks in the concrete is effectively limited without additional material or labor expenditures.

The smooth surface of the shank end sections along with the ribbed surface of the shank center section located in between contribute to a favorable redistribution of the forces in the concrete.

2.) The sub-claims 2 through 7 contain further advantageous designs of the invention.

Dowel Strip for Bent-Up Bars

PCT/EP 95/00891

The invention pertains to a dowel strip for bent-up bars in reinforced concrete beams or panels, consisting of a strip and a plurality of dowels perpendicularly welded to the strip at one of their ends and spaced apart, each having a dowel shank and, on their ends facing away from the strip, a dowel head that is wider than the dowel shank, whereby the dowel shank has ribs on at least part of its surface.

Known dowel strips of this kind (DE-PS 27 27 159.6) serve to form bent-up bars in reinforced concrete beams and panels at points of support, particularly in the vicinity of column connections, to absorb the lateral forces occurring in these areas due to stress created by the vertical columns.

In a reinforced concrete beam or concrete panel reinforced in this fashion, a grid is formed in the column area that may be described using the model of a truss, the truss members of which are referred to with the terms customarily used for trusses.

Longitudinal reinforcement bars on the topside of the beam or panel form a tension chord member in the area of the columns. The dowels of the dowel strip located perpendicular to these tension chord members represent the vertical tension members of the truss. The concrete that is in compression on the underside of the beam or the panel in the vicinity of the columns, assumes the function of the compression chord member; this function may also be assumed by the dowel strips if these extend in the longitudinal direction of the beams. Between the dowel heads on top and the points of support of the column or the dowel strips of adjacent additional dowels, sloped struts are formed in the concrete of the truss used as a model.

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The formation of a truss framework joint at the dowel head or strip, respectively, requires that the vertical tension member force is transferred all the way to the dowel head or strip, respectively, so that the differential forces can be transferred to the tension chord member or the compression chord member, respectively through a positive enclosure by the concrete.

In the known dowel strips, the dowel shank is designed smooth and cylindrical; the resulting relatively minor adhesion between the dowel shank and the concrete results in the force of the vertical tension member being transferred until it reaches the dowel head or dowel strip, respectively.

The sloped main tensile stress forming in the concrete leads to the formation of shearing cracks in the concrete extending approximately in the direction of the sloped struts, whereby their width restricts the load carrying capacity of the beam or panel.

According to a known process, the width of unavoidable shearing cracks in the concrete is limited and the carrying capacity of the structural component increased by inserting additional bent-up bars essentially extending perpendicular to the expected direction of the cracks.

In a beam or panel equipped with dowel strips serving as bent-up bars, according to this theory either the bent-up bars consisting of dowel strips would be reinforced by using more or larger diameter dowels, or a separate, additional bent-up bar would be inserted to limit the width of the cracks. Both measures, however, involve additional material and labor costs.

In a known dowel strip of the above kind (EP-A-495 334), the dowels are made from ribbed reinforcement bar; the dowel shank has ribs on its surface. The vertical tension member force acting inside the dowel shank is thus not at all or only to an insignificant extent transmitted to the end of the dowel, with the result that the desired formation of a truss framework joint at the dowel ends is impaired.

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The aim of the invention is therefore to design a dowel strip of the above type to effectively limit the width of the cracks in the concrete without additional material or labor expenditures while maintaining the effective formation of truss framework joints at the dowel heads.

This aim is attained according to the invention with a dowel shank having a smooth, cylindrical shape at its two shank end sections and a shank center section with a ribbed surface located in between.

The transmission of the force of the vertical tension member required for the formation of a truss framework joint at the two ends of each dowel is attained based on the two shank end sections adjacent to the dowel ends being smooth and therefore effecting only a very minor adhesion with the surrounding concrete. The shank center section, which preferably consists of ribbed reinforcement bar, effects the desired good adhesion between the dowel and the surrounding concrete with its ribbed surface located between the two smooth shank end sections. This adhesion limits the width of the shearing cracks forming along the sloped struts. The result is an increased load carrying capacity of the beam or panel reinforced in this fashion without the need for any additional reinforcement.

The dowel shank may be manufactured from ribbed reinforcement bar, the ribs of which are smoothed at the two shank end sections. It is also possible instead, to have a shank center section made of ribbed reinforcement bar welded to the two shank end sections made of smooth rod-steel.



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Patent Claims

1. Dowel strip for bent-up bars in reinforced concrete beams (1) or panels, consisting of a strip (5) and a plurality of dowels (6) perpendicularly welded to the strip at one of their ends and spaced apart, each having a dowel shank (7) and, on their ends facing away from the strip (5), a dowel head (8) that is wider than the dowel shank (7), whereby the dowel shank (7) has ribs (9) on at least a portion of its surface, characterized in that the dowel shank (7) has a smooth cylindrical shape at its two shank end sections (7a, 7c) and that a shank center section 7b located in between has ribs (9) on its surface.
2. Dowel strip according to claim 1, characterized in that the shank center section (7b) consists of ribbed reinforcement bar.
3. Dowel strip according to claim 2, characterized in that the dowel shank (7) is made from ribbed reinforcement bar, the ribs of which are smoothed at the two shank end sections (7a, 7c).
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