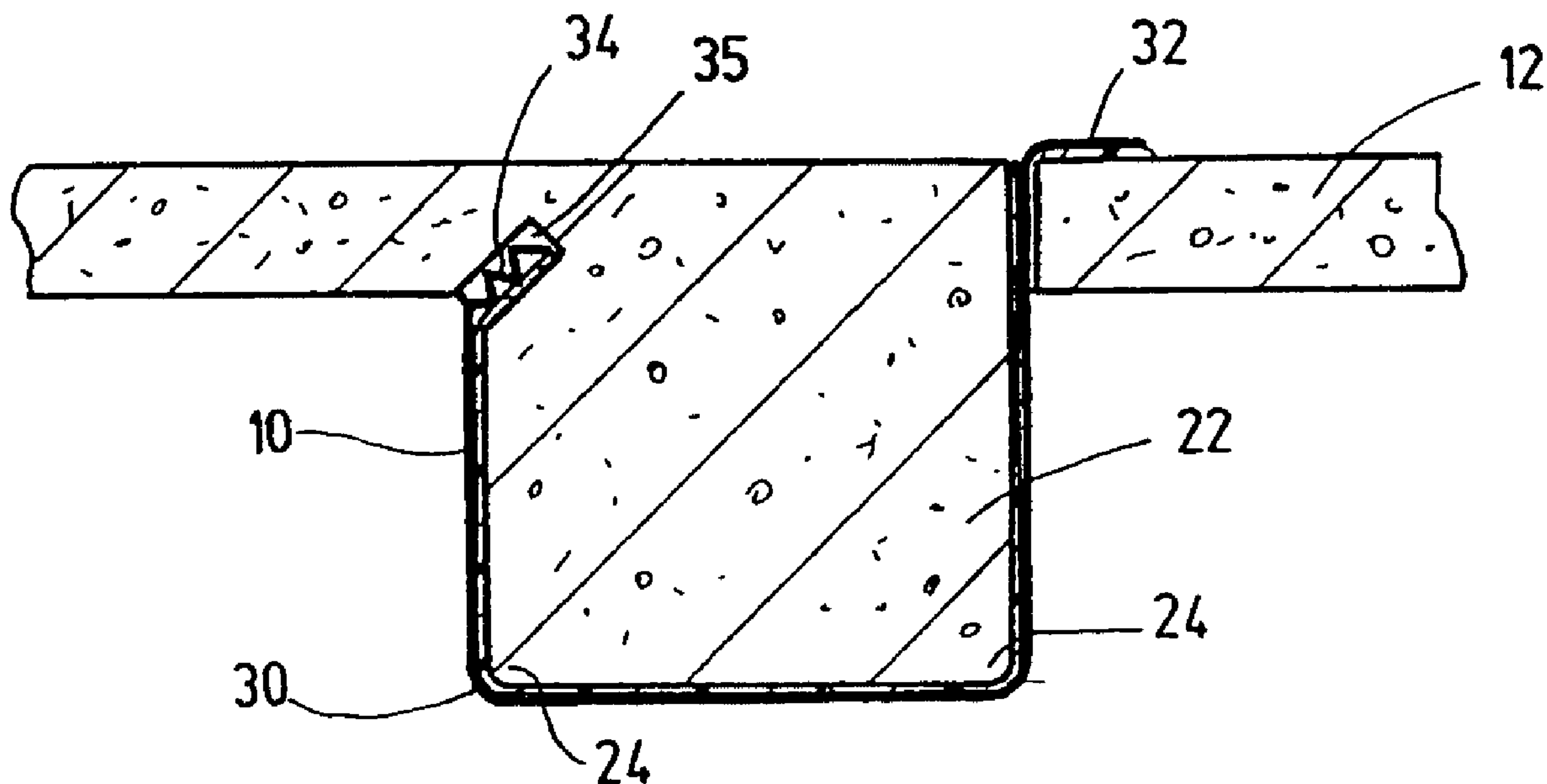




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(54) Title: FLAT STRIP LAMELLA FOR REINFORCING BUILDING COMPONENTS AND METHOD FOR PLACING A
FLAT STRIP LAMELLA ON A COMPONENT



(57) Abrégé/Abstract:

The invention relates to a flat strip lamella (10) for reinforcing load-bearing or load transferring building components e.g. concrete, wood, steel, natural stone or masonry. The flat strip lamella (10) has a composite structure consisting of a plurality of parallel aligned bendable or flexible carrying fibres (26) and a binding matrix (28) joining the carrying fibres to each other and making them shear resistant. The lamella can be attached facewise to the surface of the building component to be reinforced, using adhesive (16). In order to be able to bend the flat strip lamella over corner edges of a building component, the binding matrix (28) consists of a thermoplastic synthetic material.



ABSTRACT

The invention relates to a flat strip lamella (10) for reinforcing load-bearing or load transferring building components e.g. concrete, wood, steel, natural stone or masonry. The flat strip lamella (10) has a composite structure consisting of a plurality of parallel aligned bendable or flexible carrying fibres (26) and a binding matrix (28) joining the carrying fibres to each other and making them shear resistant. The lamella can be attached facewise to the surface of the building component to be reinforced, using adhesive (16). In order to be able to bend the flat strip lamella over corner edges of a building component, the binding matrix (28) consists of a thermoplastic synthetic material.

FLAT STRIP LAMELLA FOR REINFORCING BUILDING COMPONENTS AND
METHOD FOR PLACING A FLAT STRIP LAMELLA ON A COMPONENT

Description

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The invention concerns a flat strip lamella for reinforcing load-bearing or load-transmitting building components, which is comprised of a composite structure of a plurality of bendable or flexible reinforcing fibers aligned parallel to each other and a binder matrix which joins the reinforcing fibers to each other in a shear resistant manner, and which can be attached facewise to the outer surface of the building components by means of an adhesive. The invention further concerns a process for application of this type of flat strip lamella onto a building component.

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Reinforcing lamellas of this type are known, for example, from WO 96/21785. The therein disclosed reinforcing lamellas are applied to longitudinally extending and/or flat surfaced construction components. The reinforcing lamellas hardened with a binder matrix of a Duroplast, in particular epoxy resin, do not permit a bending with a small bending radius, so that it is not possible to form a bowed reinforcement extending over a corner of a construction component. Bowed reinforcements or sheaths are necessary for example in order to secure the connection or interrelation between the compressive and tensile zones in steel reinforced concrete girders or steel reinforced concrete T-beams and to avoid stress and transverse fractures.

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Beginning therewith the present invention is concerned with a task of developing a flat strip lamella which can reinforce a

construction component by extending over a corner thereof. A further task of the invention is comprised in the development of a process for the application of this type of flat strip lamella to construction components.

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For solving this task the combination of characteristics set forth in claim 1 as well as 6 through 9 is proposed. Advantageous embodiments and further developments of the invention can be seen from the dependent claims.

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The inventive solution is based on the recognition, that the bending flexibility of the flat strip lamellas is determined primarily by the binder matrix. In order to be able to guide the flat strip lamella also over bent construction component
15 outer surfaces and building component corners, it is proposed in accordance with the invention, that the binder matrix be comprised of a thermoplastic resin. This type of flat strip lamella can be deformed by application of a local temperature increase and then fitted to the outer surface contour of the
20 construction component to be reinforced. The glass transition point of the employed thermoplastic resin is preferably above 100°C, while the melting point should begin above 160°C, in order that a reliable manipulation is achieved. The local heating of the flat strip lamella can be achieved on site with
25 the aid of a hot air gun.

For forming the binder matrix one can consider for example a thermoplastic resin from the group consisting of polyolefins, vinylpolymers, polyamide, polyester, polyoxymethylene,
30 polycarbonate and thermoplastic polyurethane and ionomers.

The reinforcing fibers are preferably formed of carbon fibers, which are characterized by a high modulus of elasticity. The reinforcing fibers can however contain or be comprised of aramid fibers, glass fibers, polypropylene fibers and the
5 like.

For application of the inventive longitudinally extending flat strip lamella over a corner of a construction component to be reinforced it is proposed in accordance with the invention
10 that the flat strip lamella is heated in the intermediate area to be directed over the corner of the construction component to a temperature above the glass transition point of the thermoplastic binder, that it is bent in the heated condition at an angle corresponding to that of the corner or edge angle
15 of the construction component, and that before or after cooling it is adhered to the construction component over the construction edge by means of a adhesive layer.

The inventive application of a thermoplastic binder matrix
20 makes it possible to apply the flat strip lamellas in the pretensioned condition to a construction component outer surface. The free ends of the flat strip lamellas which project beyond the surface of the construction component to be reinforced can, in their heated state, be drawn or stretched
25 with a tensioning element or be bent and fixed thereupon. The tensioning elements can then be tensioned against each other so that the flat strip lamella can be adhered to the construction component outer surface in the pretensioned condition. For tensioning of the tensioning elements a
30 tensioning mechanism can be provided spaced apart from the construction component. The tensioning mechanism could also

engage only at the free end of the flat strip lamella, when the other end is fixed to the construction component outer surface by a suitable tensioning element.

5 Further there exists with the inventive thermoplastic binder matrix the possibility of pressing the free ends of the flat strip lamella under the action of pressure and heat into a wave or zigzag shape. To achieve a form-fitting anchoring, the lamella ends deformed in this manner are introduced into a
10 recess in the construction component filled with adhesive, so that the zigzag area fills with the pasty adhesive and after hardening of the adhesive forms a form fitting connection.

The flat strip lamella with the inventive thermoplastic binder
15 matrix can additionally be employed for reinforcement of column-shaped construction components. Therein the flat strip lamella heated to a temperature above the glass transition point of the binder matrix is wound in a spiral manner about a column-shaped construction component of which the outer
20 surface is coated with fluid reaction adhesive and in this wound state is cooled to room temperature with simultaneous hardening of the adhesive. In order to avoid collection of liquids below the flat strip lamella winding, it is advantageous, when a separation is maintained between the
25 spiral windings of the flat strip lamella.

In order to improve the bond between the flat strip lamella and the adhesive, such as epoxy resin, it can be advantageous, when the flat strip lamella is freed of binder with
30 simultaneous exposure of the reinforcing fibers on the side to be adhered, for example by roughening or grinding.

In the following the invention will be described in greater detail by reference to the embodiment shown in schematic manner in the drawings. There is shown

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Fig. 1a a top view of a section of a reinforcing lamella;

Fig. 1b an enlarged representation of a section along section line B-B of Fig. 1a;

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Fig. 2 a section through a steel reinforced concrete T-beam with bow-shaped bent reinforcing lamella;

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Fig. 3 the one end of the reinforcing lamella, which can be introduced into the recess in the construction component according to section III of Fig. 2;

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Fig. 4 a tensioning device for pretensioned application of the reinforcing lamella to a construction component;

Fig. 5 a sectional side view of a column-shaped construction component with a reinforcing lamella wound about in spiral manner.

25 The flat strip lamellas 10 shown in the drawings are designed for post reinforcement of construction components 12, such as steel reinforced concrete structures and masonry structures. They are secured at one of their face sides 14 against the outer surface of the construction component with the aid of an
30 adhesive 16, preferably an epoxy resin, and supplementally

anchored at their free ends 32, 34 to the construction component 12 (Fig. 2).

The construction component 12 according to Fig. 2 is formed in this example as a steel reinforced concrete T-beam, in which the lamella 10 extends in a bow like manner over the cross beam 22 of the construction component 12 and thereby is bent over the corner edges 24 of the cross beam 22.

10 The flat strip lamella 10 has a composite structure of a plurality of parallel aligned bendable or flexible reinforcing fibers 26 of carbon fiber and of a binder matrix which joins the reinforcing fibers in a shear resistant manner, the binder matrix being comprised of a thermoplastic resin. The
15 thermoplastic binder matrix 28 ensures that the flat strip lamella is relatively stiff at temperatures of use and is plastically deformable upon heating to a temperature above the glass transition point. In order to initially guide the longitudinally extending flat strip lamellas 10 over the
20 corners 24, they are heated in the intermediate area 30 to a temperature above the glass transition point of the thermoplastic binder matrix and plastically bent about the edge angle, which may be rounded off, at approximately 90°. This bend remains retained after the cooling to the
25 temperature of use.

In the illustrative embodiment shown in Fig. 2 the plastic deformability under increased temperature of one end 32 of the flat strip lamella is also taken advantage of in the anchoring
30 process. The bent-away end 32 is adhered to the construction component 12 with an adhesive 16. At its other free end 34,

the flat strip lamella exhibits a zigzag-shaped deformation, with was produced under the action of pressure and heat. With this end 34 the flat lamella 10 penetrates into an adhesive filled recess 35 of the construction component 10 and forms a
5 form-fitting anchoring upon hardening of the adhesive in this recess.

In the embodiment shown in Fig. 4 the free ends 36 of the flat strip lamella 10 are drawn in the heated, plastic
10 deformed condition upon drum-shaped tensioning elements 38 and are anchored there. The tensioning elements 38 can, under the influence of a suitable tensioning mechanism, be displaced in the direction of the double arrow 39 towards each other so that the flat strip lamella 10 is pretensioned during adhering
15 to the construction component 12 with the aid of the adhesive 16. If the pretensioning is maintained until the hardening of the adhesive, one attains an improvement in the reinforcing effect.

20 In the embodiment shown in Fig. 5 a flat strip lamella 10 is wound in a spiral manner upon a column-shaped construction component 12 and adhered thereto. In order to facilitate the winding, the flat strip lamella is subjected to an elevated temperature, so that during winding it can easily be brought
25 to its spiral shape.

In summary the following is to be concluded: The invention concerns a flat strip lamella 10 for reinforcing load-bearing or load-transmitting building components e.g. concrete, wood,
30 steel, natural stone or masonry. The flat strip lamella 10 has a composite structure consisting of a plurality of

parallel aligned, bendable or flexible carrying fibers 26 and a binding matrix 28 joining the carrying fibers to each other and making them shear resistant. The lamella can be attached facewise to the surface of the building component to be reinforced, using adhesive 16. In order to be able to bend the flat strip lamella over corner edges of a building component, it is proposed in accordance with the invention that the binding matrix 28 consists of a thermoplastic resin material.

Patent claims

1. Flat strip lamella for reinforcing load-bearing or load-transmitting building components (12), preferably comprised of concrete, which comprises a composite structure of a plurality of parallel-aligned bendable or flexible reinforcing fibers (26) and a binder matrix (28) which joins the reinforcing fibers in a shear-resistant manner, and which can be attached facewise to the outer surface of the reinforcing construction component (12) by means of an adhesive (16), characterized therein, that the binding matrix (28) consists of a thermoplastic resin.
2. Flat strip lamella according to claim 1, characterized therein, that the glass transition point of the thermoplastic resin is at least 100°C and the melting point is at least 160°C.
3. Flat strip lamella according to claim 1 or 2, characterized therein, that the thermoplastic resin is selected from the group consisting of polyolefins, vinylpolymers, polyamide, polyester, polyacetale, polycarbonate, polyurethane and ionomers.
4. Flat strip lamella according to one of claims 1 through 3, characterized therein, that the reinforcing fibers are or include carbon fibers.
5. Flat strip lamella according to one of claims 1 through 4, characterized therein, that the carrying fibers are or

include aramid fibers, glass fibers or polypropylene fibers.

6. Method for attachment of a premanufactured longitudinally extending flat strip lamella according to one of claims 1 through 5 to a construction component (12) over at least one corner edge (24), characterized therein, that the flat strip lamella is heated in the intermediate area (30) to be applied over the corner (24) of the construction component to a temperature above the glass transition point of the thermoplastic binder, that it is bent in the heated condition at an angle corresponding to that of the corner or edge angle of the construction component, and that before or after cooling it is adhered to the construction component over the construction edge by means of a adhesive layer (16).
7. Method for attachment of a premanufactured flat strip lamella according to one of claims 1 through 5 to a construction component surface, characterized therein, that the flat strip lamella (10) with each free end in a heated condition is drawn or bent upon a respective tensioning element, and is arrested thereto, and that the tensioning elements (38) are tensioned against each other and the flat strip lamella (10) is adhered to the construction component surface in this pretensioned condition.
8. Method for attachment of a flat strip lamella according to one of claims 1 through 5 to a construction component with the aid of an adhesive, characterized therein, that

a wave or zigzag shape is pressed in into the free ends (34) of the flat strip lamella (10) under the application of pressure and heat, and while inserting the lamella ends (34) into a construction component recess the wave or zigzag areas are filled with adhesive under production of a form fitting connection.

9. Method for attachment of a flat strip lamella according to one of claims 1 through 5 to an construction component with the aid of an adhesive, characterized therein, that the flat strip lamella is heated to a temperature above the glass transition pint of the binder is wound in a spiral manner about a column-shaped construction component and in this wound state is cooled to room temperature with simultaneous hardening of the adhesive.
10. Method according to one of claims 6 through 9, characterized therein, that the reinforcing fibers (26) are at least partially exposed by removal of binder (28) from the surface of the side which is to be connected with the construction component.

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Fig. 1a

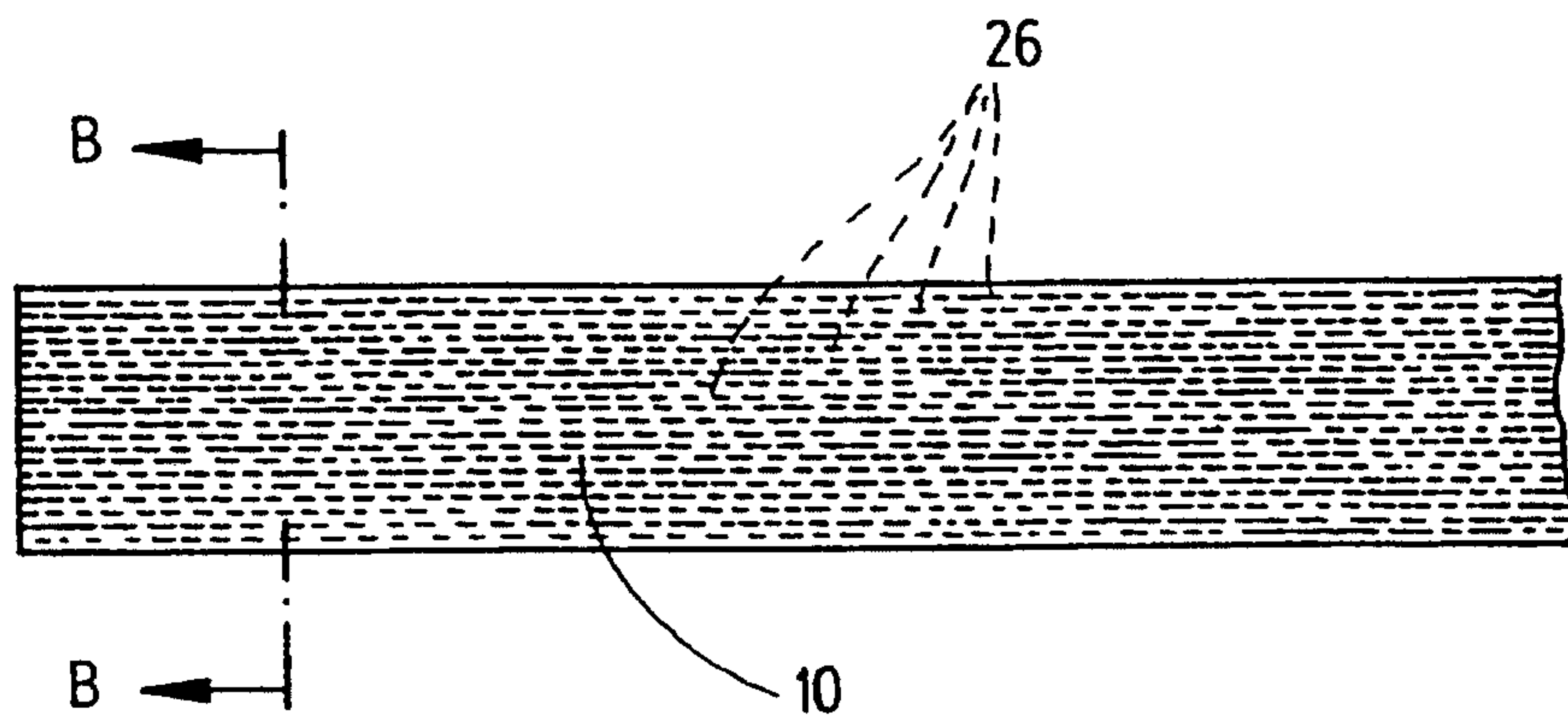


Fig. 1b

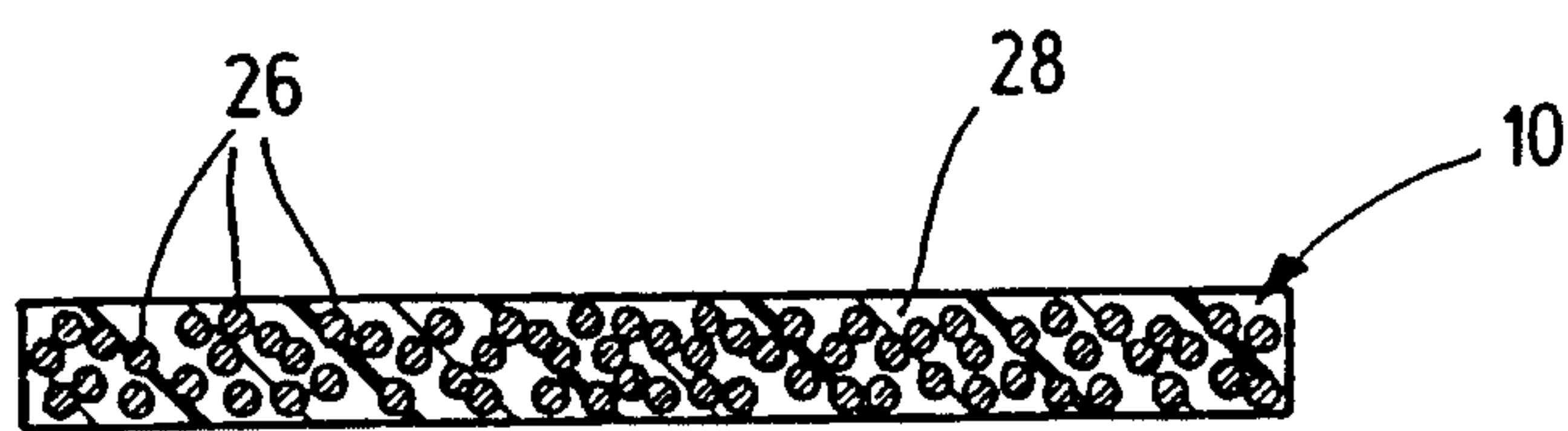


Fig. 4

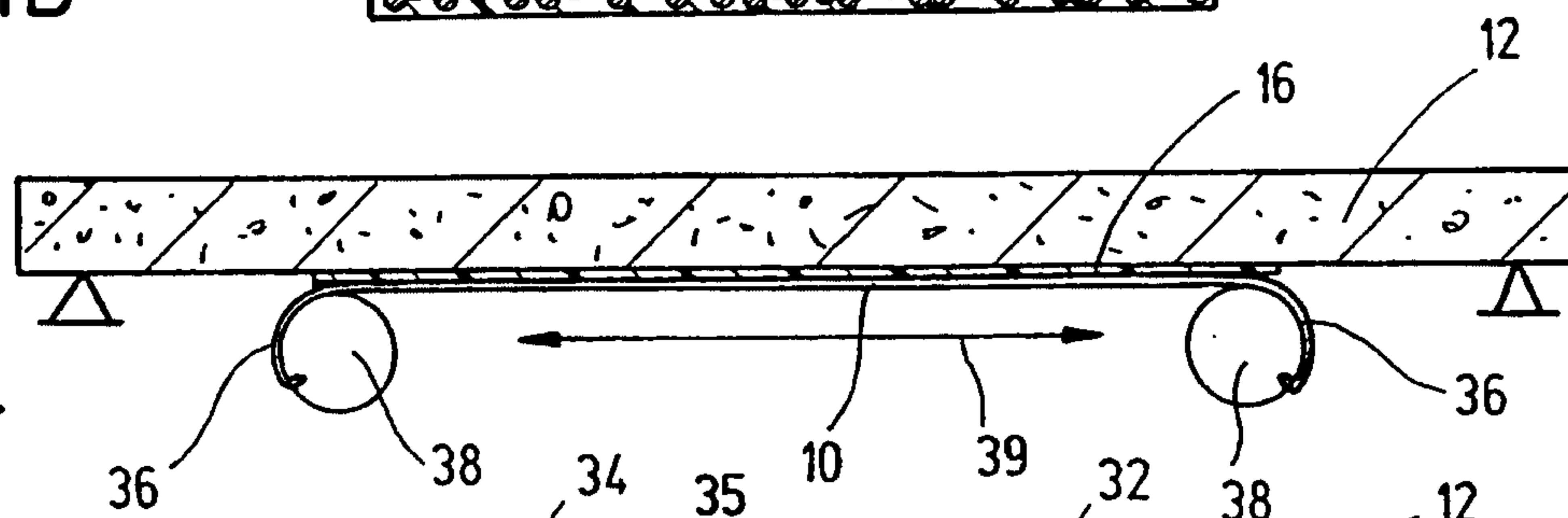


Fig. 2

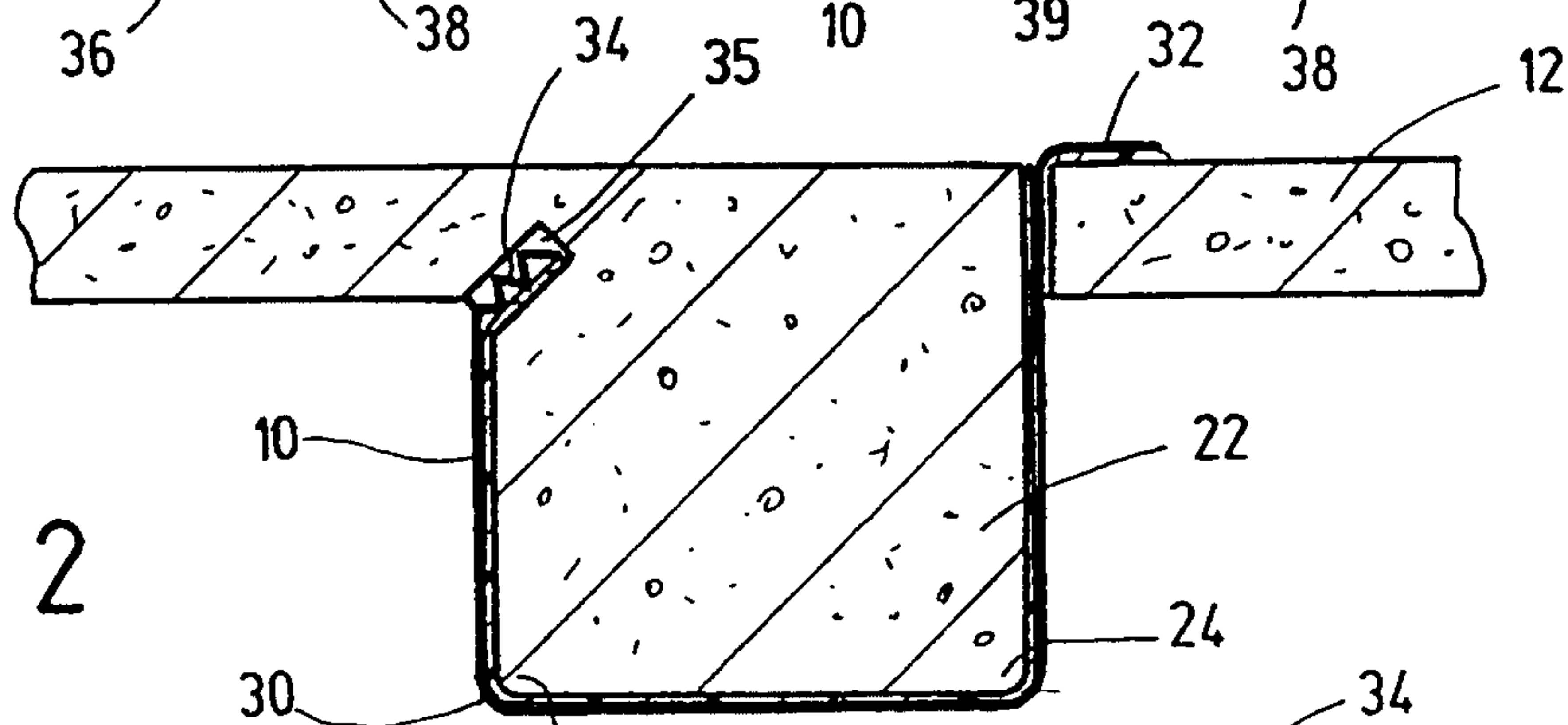


Fig. 3

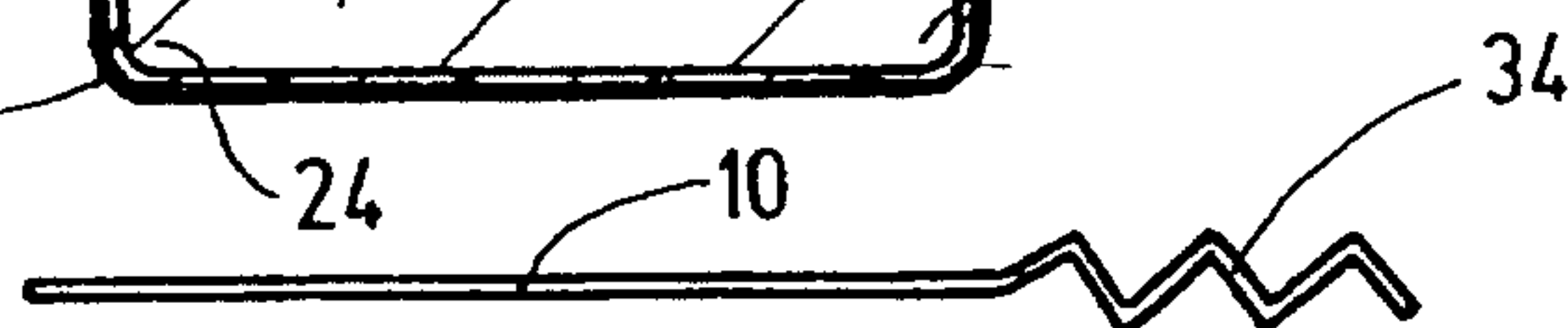


Fig. 5

