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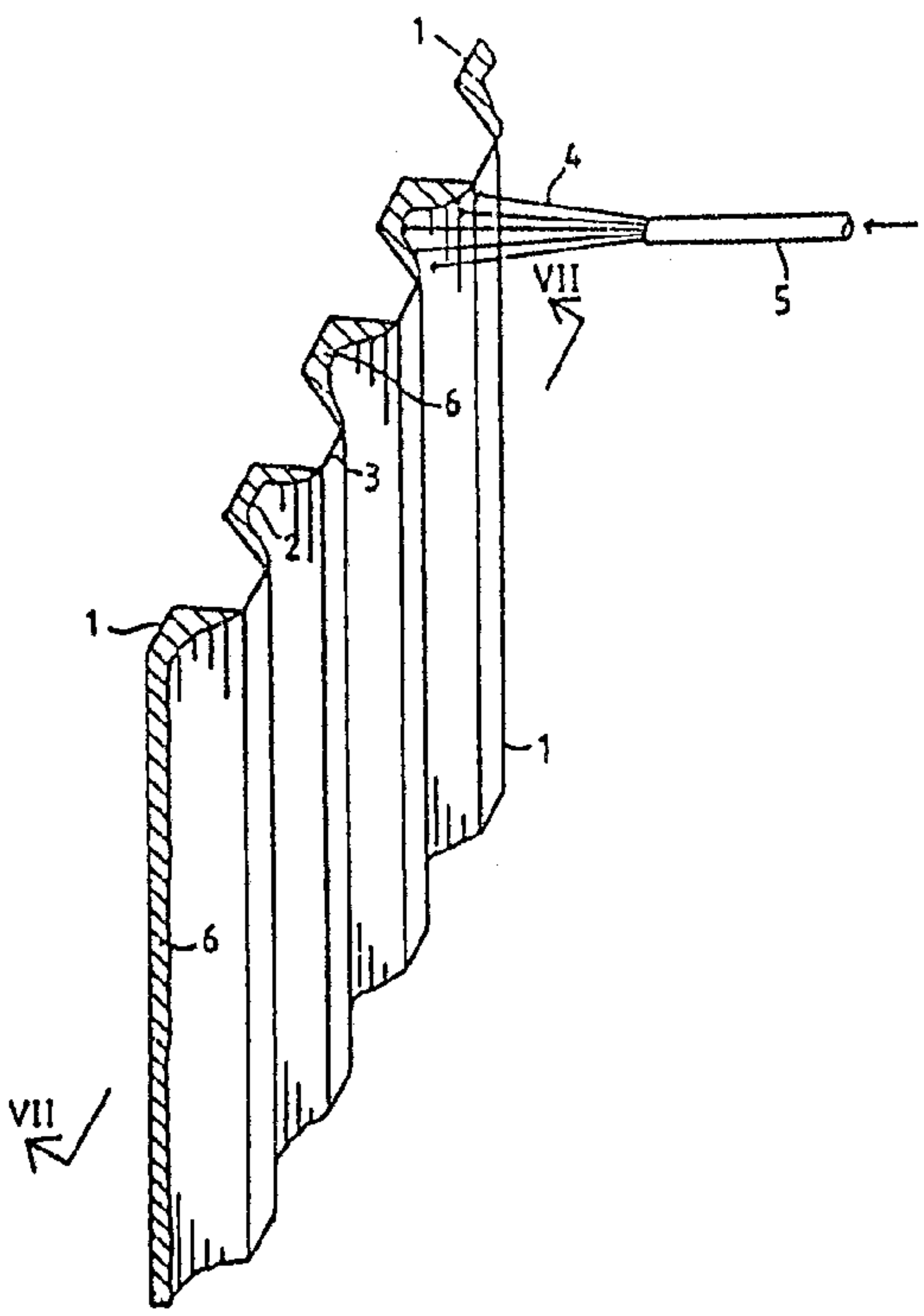
(54) **METHODE DE FABRICATION DE STRUCTURE COMPOSITE**

(54) **METHOD FOR THE FABRICATION OF A COMPOSITE STRUCTURE**



(57) On décrit un procédé de fabrication d'une structure composite sous forme de combinaison d'une plaque profilée (1) et de béton. La plaque profilée (1) est généralement une plaque profilée en acier. Du béton est amené à la structure composite en projetant du béton (4) sur la surface de la plaque profilée (1). Avant la projection du béton, la plaque profilée (1) relativement légère peut être placée sur un chantier de construction de structures composites. La projection du béton peut être effectuée par étapes et une couche à la fois en permettant aux couches de durcir au moins en partie entre chaque étape de projection. Ainsi, la capacité portante de la structure augmente en fonction de l'augmentation de son poids.

(57) The invention relates to a method for the fabrication of a composite structure as a combination of a profile plate (1) and concrete. The profile plate (1) is usually a steel profile plate. Concrete is brought to the composite structure by spraying concrete (4) onto the surface of profile plate (1). Prior to the spraying of concrete, the relatively light profile plate (1) can be placed at a composite structure building site. The spraying of concrete can be effected step by step and layer by layer by allowing the layers to set at least partially between the spraying steps. Thus, the inherent load-bearing capacity of the structure increases as its weight increases.

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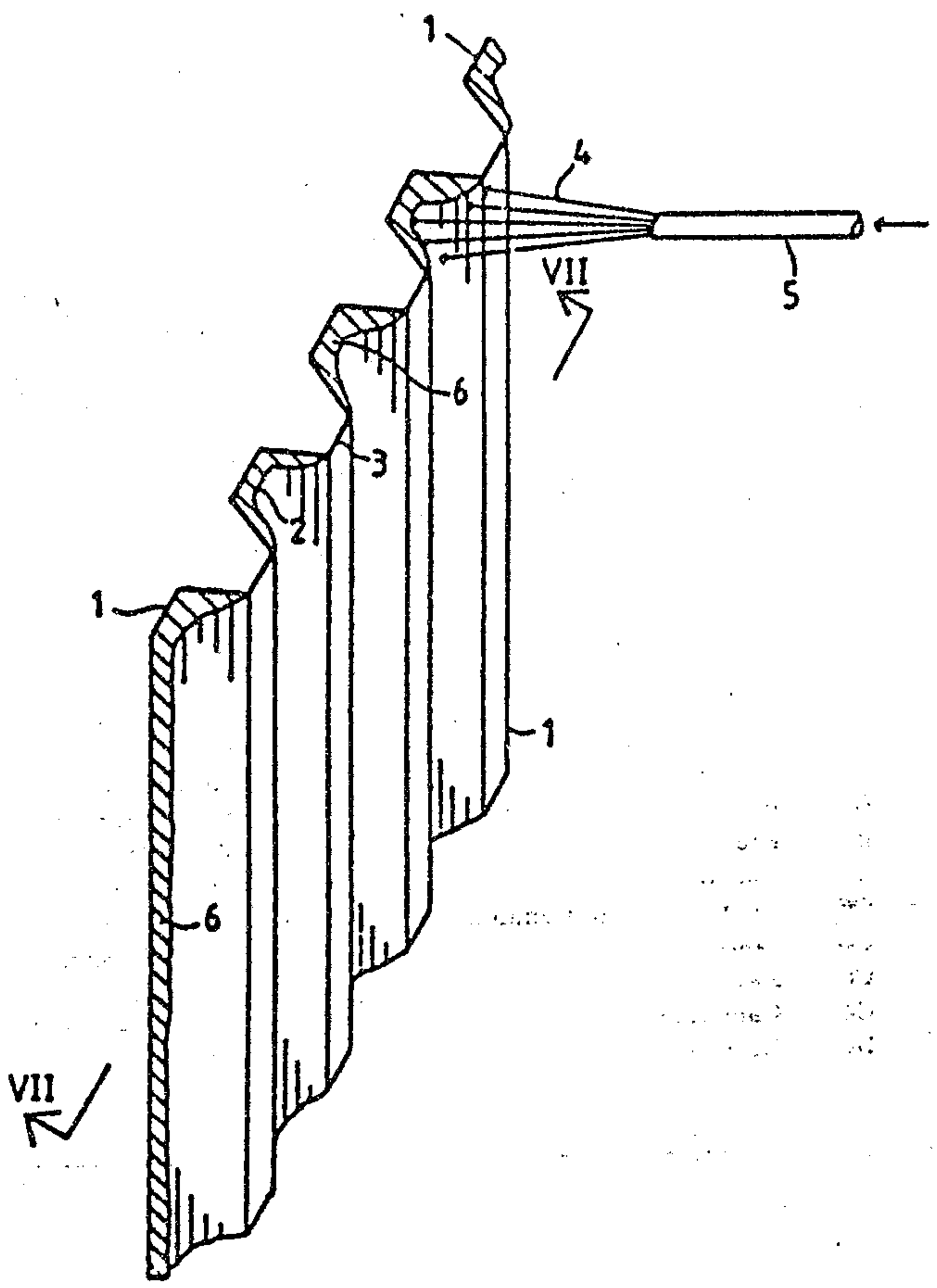
(54) Title: METHOD FOR THE FABRICATION OF A COMPOSITE STRUCTURE

(57) Abstract

The invention relates to a method for the fabrication of a composite structure as a combination of a profile plate (1) and concrete. The profile plate (1) is usually a steel profile plate. Concrete is brought to the composite structure by spraying concrete (4) onto the surface of profile plate (1). Prior to the spraying of concrete, the relatively light profile plate (1) can be placed at a composite structure building site. The spraying of concrete can be effected step by step and layer by layer by allowing the layers to set at least partially between the spraying steps. Thus, the inherent load-bearing capacity of the structure increases as its weight increases.



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Method for the fabrication of a composite structure.

The present invention relates to a method for the fabrication of a composite structure as set forth in claim 1 for various building components.

The use of composite structures is known as such since the combination of a shaped plate and concrete can be employed for building preferred composite structures, wherein a generally stell-made profile plate serves as a component more resistant to tensile stresses and concrete, on the other hand, serves as a structural component primarily taking up compressive forces. This type of composite structures have been disclosed e.g. in Patent publications FI 57295, GB 1 469 478, DE 24 13 645 and DE 26 04 998. The profile plate often serves as a mould for pouring concrete mass thereon. The grip between concrete and a profile plate can be improved by means of various holes and knobs and recesses made in the profile plate. Tensile stresses can be taken up also by means of various additional steels. Patent publications US 4 121 943 and US 4 559 276 disclose a method for manufacturing steel-fiber concrete, wherein the tensile stresses of concrete are transferred to thin fibers mixed in concrete. Also known is injection of concrete in several applications.

A drawback in the prior known manufacturing methods of composite structures is the restrictiveness to a substantially horizontal position, casting technique and one-sided loading. Another drawback is the use of generally just one type of concrete in various parts of a structure and the production of unnecessarily thick structures. This still results in a structure having a relatively heavy dead weight and yet a relatively low strength. In many applications, it is necessary to use temporary moulds and support stands on the construction site and those must be subsequently disassembled. The profile plate in itself is not sufficiently strong to serve as a casting mould under fresh concrete mass without addition reinforcement.

Several composite structures require the use of conventional concrete reinforcement which increases the costs. The conventional iron-bar reinforcement of concrete does not often work in an optimum fashion due to position and shape. Too much expensive steels are generally used in view of what is actually needed, since stells are not positioned exactly where the tensions are. In prior known composite structures, the freedom of designing the end product is also limited due to the working technique. Fixing of additional components to the structure is inconvenient.

As a result of the inconvenience of the prior known fabrication methods of composite structures, it is in many cases preferable to manufacture elements in a factory and carry them to the construction site to be erected. This, however, leads to the inconvenience of having to carry around heavy building elements that might be damaged during transport. Heavy-duty transport and lifting equipment cannot be brought to every corner of a construction site and incurs extra costs.

An object of this invention is to alleviate the above drawbacks and this is accomplished by a method of the invention by spraying concrete to a profile plate.

The equipment intended for carrying out a method of the invention is described later in the claims.

A large number of various applications can be found for the invention. The accompanying drawings only serve as examples and to illustrate one embodiment of the invention.

Fig. 1 shows one vertical profile structure of the invention at the injection or spraying stage.

Fig. 2 shows the vertical profile structure of fig. 1 from the other side during the injection.

Fig. 3 is a horizontal section along the line III-III in fig. 2.

Fig. 4 shows one alternative horizontal section along the line III-III in fig. 2.

Fig. 5 shows a second alternative horizontal section along the line III-III in fig. 2.

Fig. 6 shows a third alternative section in a structure of the invention.

Fig. 7 shows one possible horizontal section along the line VII-VII in fig. 1.

Fig. 8 shows one alternative detail of the horizontal section in fig. 7.

Fig. 9 shows a component number 13 of fig. 8 prior to the attachment.

Fig. 10 shows one possible section along the line X-X in fig. 8.

Fig. 11 shows one cross-section of the invention prior to injection and partially injected.

Fig. 12 shows one alternative arrangement in the section of fig. 11.

Fig. 13 shows one structure of the invention prior to injection.

Fig. 14 shows in section a way of fastening the meshes prior to injection.

Fig. 15 shows in section another way of fastening the meshes prior to injection.

Fig. 16 shows a foundation or support wall structure of the invention at the injection stage.

Fig. 17 shows one possible section along the line XVII-XVII in fig. 16 after the injection.

Fig. 18 shows one bridge structure of the invention during the injection.

Fig. 19 shows one possible cross-section along the line XIX-XIX in fig. 18.

Fig. 20 shows in section a third way of fastening the meshes prior to pressing the recesses together.

Fig. 21 shows the section of fig. 20 after pressing the recesses together.

Fig. 22 shows a detailed view of one composite structure of the invention.

Fig. 23 shows one possible section along tne line VII-VII in fig. 22 prior to the addition of concrete mass.

Fig. 24 shows one alternative section along the line VII-VII in fig. 22 after the partial addition of concrete mass.

Fig. 25 shows a detailed view of one bridge embodiment of the invention.

Fig. 26 shows one possible horizontal section along the line XII-XII in fig. 25.

Fig. 27 shows a cross-section of one bridge embodiment of the invention.

The essential purpose of this invention is to provide a composite structure of concrete and steel by injecting concrete to the surface of a profile plate for increasing the thickness of the structure during injection. The forceful striking of shotcrete on a substrate provides a good compaction and creates a superior concrete strength as compared to cast concrete. Thus, if desired, a method of the invention can be used to produce thin and stable monocoque structures. Shotcreting or concrete spraying provides also a possibility of designing the end product in a variety of shapes.

The invention can be readily applied to produce even large building components in a manner that the actual structure is not formed until at the construction site from injection or spraying layers. Heavy elements or other major components need not be moved around. The work can be performed by means of relatively small-scale and simple spraying equipment. The profile plate consists of a thin and relatively light material, so it can be readily handled at the construction site without the weight of concrete.

If desired, the structure can be formed by using a variety of concrete layers for providing the end product with desired qualities. The structural components susceptible to tensile stresses can be injected e.g. from fibrous concrete and the components susceptible to noise can be made of a noise-absorbing porous material. The noise-absorbing or structure-lightening material can be haydite-containing light concrete or foam mortat. In the mass to be sprayed or injected can be admixed cement- or concrete-coated bits of cellular plastic or pieces of wood for increased porosity.

The profile plate serves as a part of the reinforcement in the final structure but, whenever necessary, it is possible to place between various injection layers some extra reinforcements, e.g. reinforcing meshes generally at the points of severest stresses, including common ribbed bar reinforcement, prestressed steels etc. The reinforcement can be added stepwise during construction as the preceding concrete layers are set and capable of bearing the subsequently added mass.

The spraying of concrete can be effected conventionally by applying a dry-spraying process or a wet-spraying process.

In many cases, the invention can be used to avoid the building of stands and moulds and, thus, to achieve cost savings. The already set shotcrete layers serve partially as a mould for subsequent layers together with a profile plate.

Fig. 1 shows in principle the coating of a profiled plate 1 with concrete 6. Concrete is generally supplied by the application of pressure from a pipe 5 towards profile plate 1, having regions of valleys 2 and ridges 3 as seen from the spraying side. A concrete layer 6 is usually first deposited on the bottom of valleys or recesses 2 with a concrete spray 4 deflecting from the inclined faces of profile plate 1. The profile plate 1 is generally and preferably made of steel. Thus, the adhesion of concrete 6 to the surface of profile plate 1 can be promoted by making profile plate 1 temporarily magnetic by means of an electromagnet and by spraying to plate 1 such a concrete mass 4 which contains magnetizable particles, e.g. filings or steel fibers. In fig. 1 the profile plate is shown in a vertical position e.g. for building a fence, a wall structure or a noise barrier. The structure can also be set in a horizontal or inclined position. In the case shown in fig. 1, the ridge sections 3 can also be coated with concrete 6.

Fig. 2 shows the spraying of concrete also to the opposite side of a profile plate 1. Thus, over the entire length of plate 1 there is obtained a composite structure, reinforced with concrete 6 and in which the valley sections 2 only are shotcreted.

Fig. 3 shows in section a composite structure, wherein both sides of a profile plate 1 are coated with a shotcrete layer 6 which substantially conforms to the basic configurations of profile plate 1. Thus, a steel profile plate is protected from corrosion with alkalic concrete. At the same time, the vertical flexural rigidity of the structure has increased to exceed considerably that of a mere profile plate 1. The structure shown in fig. 3 can be used as a single noise barrier.

In fig. 4, one of the concrete surfaces of a composite structure is shaped as a flat surface 9, e.g. for the facade of a building. The flat surface 9 can be made e.g. by levelling a moist shotcrete surface right after the spraying. As an alternative, it is possible to employ temporarily a flash mould, whereby spraying 4 is effected in vertical direction generally from above in between profile plate 1 and a flash mould. The structure is provided with sturdy pillars 8 on one side of profile plate 1 while the principal configuration of the other side is left to follow profile plate 1 and to be lightweight with its recesses.

Fig. 5 shows a horizontal section of a structure, wherein one side of a profile plate carries a robust shotcrete layer 6 of e.g. fibrous concrete and the other side is provided with porous concrete 7. The illustrated structure can serve as a noise barrier in a manner that the porous concrete layer 7 is positioned to face the noise for absorbing sound waves and the sturdy other side 6 holds the structure upright e.g. against wind forces. Even on the side of porous concrete it is possible to spray strong concrete 6, if required by strength.

Fig. 6 illustrates a horizontal section of a noise barrier according to the invention, wherein on one side of a profile plate is sprayed a layer 7 of porous concrete. The structure is then fitted with clamps 20 for fastening a mesh or a non-woven fabric 10 on which is sprayed fibrous concrete mass or a cement glue 11 for a thin layer. The incoming noise wave 21 is able to penetrate through thin concrete layer 11 and mesh 10 into intrastructural cavities 12 in which the noise remains as an echo and gradually disappears in porous concrete layer 7.

Fig. 7 shows in a section an embodiment, wherein the valley regions 2 of a profile plate 1 are provided with meshes 10 for promoting the adhesion of shotcrete mass 6 to the surface of profile plate 1. The meshes 10 can be made of a thin steel sheet by cutting as a so-called expanded metal sheet, the elongation of which forms holes for the penetration into concrete mass. It is also possible to employ conventional concrete meshes. The first concrete sprays onto profile plate 1 and mesh should be preferably effected by the application of a low pressure or a spraying distance longer than normal for the mass not to bounce off the flat surface. The rugged configuration of mesh 10 improves the situation e.g. in the case of an expanded metal sheet. The mesh 10 can be loose at the valley regions 2 of a profile plate or it can be temporarily attached magnetically by magnetizing a profile plate 1 with an electromagnet e.g. on the side opposite to the spraying side for the duration of spraying. The mesh 10 can also be attached to profile plate 1 by means of rivets, welding or wire bindings. If necessary, the profile plate 1 can be entirely coated with a mesh 10 even on both sides prior to spraying. As soon as even a thin layer 6 of concrete has been adhered to the surface of profile plate 1, it will be easy to add concrete 6 thereon. The gripping characteristics of fresh concrete 6 are excellent.

Fig. 8 shows how a mesh 10 is secured to a profile plate 1 by means of a clip 13 which is pressed through profile plate 1 via holes 19 and bent to have the ends 18 towards each other for binding meah 10 firmly to profile plate 1.

Fig. 1 shows one configuration of a clip prior to pressing through profile plate 1. The clip ends 18 can be threaded for improving the gripping in concrete.

Fig. 10 illustrates a cut-out mesh 10 secured by means of plate-like clips 13 to a profile plate 1. The mesh of expanded metal sheet includes uncut portions 17 of thin sheet, having a high tensile strength especially in the non-elongated mesh direction 16. The mesh is preferably placed in a manner that the major tensile stresses in the structure will extend in direction 16. Generally this direction is the direction of ridges 3 and valleys 2. Thus, such a mesh 10 adds to the strength of a composite structure.

Fig. 11 illustrates an embodiment, wherein the ends of a mesh 10 are pressed into recesses 14 of a profile plate 1 for securing the mesh more firmly in position. The recesses 14 serve also to prevent detachment of finished concrete from a profile plate 1 since the crosswise recess surfaces 31 are subjected to compressive forces. A concrete layer 6 obtained after the spraying serves in a way as a compression pillar 77, which is reinforced with mesh 10 and acts between the extensive basic configurations 1 of a profile plate and generally minor crosswise portions 31. The pillars 77 are just imaginary structural components. In reality, they are just parts of the larger amount of concrete mass. The crosswise portions 31 and mesh 10 are of major importance in terms of holding profile plate and concrete layer together. If necessary, there may be a dense pattern of crosswise portions 31 in profile plates.

Fig. 12 shows an embodiment similar to that of the preceding figure, which is further provided with a spring 15 for improving the retention of a mesh 10, said spring pressing the mesh into recesses 14. The mesh 10 itself can also be designed as a spring.

Fig. 13 illustrates an embodiment, wherein meshes 10 are mounted on different sides of a profile plate 1, the ends of the meshes abutting against each other from different sides of crosswise faces 31. Thus, the reinforced successive concrete pillars 77 produced during spraying can also be made lean on each other as a result of compressive forces.

Fig. 14 shows an embodiment, wherein a mesh 10 is attached to recesses 14 of a profile plate 1 by pressing profile plate 1 on either side of recesses 14 firmly around mesh 10. The uncut portion 17 of an expanded metal sheet mesh 10 is bent to extend outwards from a profile plate and collapsed towards profile plate 1 so as to provide the mesh 10 with lateral extensions 22 on either side of a portion 30 extending in the same direction as profile plate 1. The profile plate extensions 22 bind a mesh 10 in a subsequently made concrete layer. If necessary, such a strong mesh 10 can serve even as a substantial reinforcement in a structure. In this case, the imaginary pillar 77 is partially horizontal and partially vertical. The adjacent lateral extensions 22 of a profile plate can be brought into contact with each other, whereby the imaginary pillars 77 push each other buttwise during pressing.

Fig. 15 shows an embodiment, wherein meshes 10 are mounted on either side of a profile plate 1 by pressing together adjacent recesses 14 and the parts of profile plate 1 therearound.

Fig. 16 illustrates a foundation of the invention, wherein a profile plate 1 is coated by spraying thereon a concrete layer 6 for increasing the strength of a profile plate as a casting mould at a subsequent stage. By increasing the width of a footing 65 with subsoil 23 in a one-sided manner it is also possible to create a support wall that can be filled with cast concrete, if desired. Prior to casting, the separate halves made by shotcreting are bound to each other e.g. with steel clamps. Fig. 16 can also be applied when building a platform structure.

Fig. 17 shows a horizontal section of a foundation provided with a heat insulation 24 on one side of a profile plate. An intermediate space 40 in the foundation can be filled in a per se known manner with cast concrete.

Fig. 18 illustrates a bridge structure of the invention, wherein a bridge-bearing structure is made by gradually adding layers of shotcrete on top of a profile plate 1.

Profile plate 1 serves initially as a mould and a stand for the structure. A profile plate 1 can be pre-assembled into a configuration corresponding to a bridge structure, e.g. alongside the working site into a large-size structure. The assembly of a desired profile plate unit 1 can be performed by using profile plate elements, supported e.g. on the ground, ice or pontoons. Profiled elements 1 can be linked together by per se known methods, e.g. by means of rivets, spot welding or screws. A profile plate unit 1 corresponding to the structure is carried over to rest on bridge supports 60. The thin sheet structure is relatively light so the transfer of even large structural components is possible. During the transfer, the concrete layers increasing the weight of a structure are not yet present in substantial amounts. Even during the transfer, it is possible that a profile plate has attached thereto some steel meshes 10 or special bracings 50 for increasing strength during the transfer. When the profile plate structure serves as a mould and a stand for a large-size bridge, the strength for the duration of work can be increased by means of temporary diagonal cables or other strut arrangements until the structure has reached a sufficient inherent strength. The extensive surface of profile plate 1 are preferably provided with suitable profiled shapes for increasing rigidity particularly prior to the reinforcing effect of concrete.

A concrete structure for the actual bridge is generally sprayed only after setting a profile plate 1 in position or nearly in position. The spraying sequence can be planned in a manner that there are first formed strength-increasing layers adjacent to supports 60. Generally, these concrete layers are allowed to set before the spraying is continued elsewhere. Between various concrete layers it is possible to include reinforcement meshes 10 as planned in a manner that the spots under the severest stresses are provided with most reinforcement meshes 10 or the meshes are stronger at these spots. Also prestressed cables can be fitted between various shotcrete layers for increasing the strength of a finished structure. For improving the strength of a profile plate unit 1 for the transfer, it is possible to spray a certain amount of concrete onto suitable spots of profile plate 1 even before the transfer.

Fig. 19 illustrates a cross-section of a bridge of the invention. The upper edge of a profile plate 1 is provided with profile plate extensions 60 in a manner that between extension 60 and profile plate 1 there will be a chute-like space 70. This chute-like space 70 can be filled with concrete for increasing the strength of the

2066693

edge of a profile plate 1. The reinforcement of chute-like space 70 with concrete can be done even before transferring the load-bearing structure to its final position. Fig. 19 shows also meshes 10 fitted between various shotcrete layers. The concrete-filled chute-like spaces 70 serve as junctions between a bridge deck 80 and the load-bearing structure. The bridge deck 80 can be built by the method of the invention e.g. on top of a profiled plate which is placed crosswise relative to the load-bearing structure of the bridge. Thus, the chute-like spaces 70 can be fitted with catching means between load-bearing structure and deck 80. The bridge deck 80 can also be made traditionally by using elements or by casting in situ.

Fig. 20 shows an embodiment, wherein a mesh 10 promoting the adhesion of shotcrete 4 to the surface of a profile plate 1 is fitted in recesses 14 of a flat profile plate 1. The side walls 62 of recesses 14 can be pressed together as shown in fig. 21 for securing the mesh firmly between walls 62. Thus, a mesh 10 remains tightly secured to profile plate 1 preventing the detachment of a subsequently made shotcrete layer from profile plate 1. The uncut sheet portions of a mesh can be bent into recesses 14 and pressed tightly between side walls 62. The adhesion of concrete to the surface of a profile plate 1 at the initial stage of spraying can also be promoted by roughening the profile plate surface e.g. by means of a large number of ragged-edged perforations or knurls.

Fig. 22 shows in a perspective view one composite structure of the invention, wherein joint profiles 32 are horizontal parallel to the profiles of a plate 1. On top of a profile plate 1 and a mesh 10 is sprayed a rather thin layer of concrete 6. which, upon setting, gives the structure such a strength that heavier concrete mass 99 can be cast without special support systems. Side extensions 22 and mesh 10 together serve to hold the concrete firmly secured to a profile plate 1 in a manner that its tensile strength can be fully utilized. The joint profiles 32 can also be made on different levels, if desired. As seen from the side, a surface 30 can e.g. corrugate in vertical direction, whereby the width of side extensions 22 may vary. Thus, the plate elements cannot move relative to each other. If desired, the structure can be prestressed by drawing profile plate 1 and mesh 10 in the direction of the shaped profiles during casting, the steels 10 and 1 subsequently creating in concrete 6 and 99 a compressive force for increasing its strength. Particularly the shapes of expanded metal sheet 10 make the prestressing possible as steel is not able to slide relative to concrete.

Fig. 23 shows one possible section along the line VII-VII in fig. 22 prior to concreting. Between a joint profile 32 and plate elements 1 and 10 forms after the concreting a pillar-shaped compression zone 77, wherein the concrete through its compressive strength retains the plate structure firmly in concrete mass.

Fig. 24 shows an alternative section along the line VII-VII in fig. 22. In this case, the corrugations of plate elements 1 and 10 are dimensioned to leave a space 36 between the extensive portions of the plate elements. Through the apertures of expanded metal sheet 10 concrete 6 can also fill this space 36 for building a pillar-like compression zone 77 therein the same way as below a joint profile 32. By placing an expanded metal sheet 10 further away from profile plate 1 the stresses can be distributed over a larger area in concrete mass 6. In the case of fig. 8, there is an empty space 35 inside the joint profile 32. It may have formed by not wishing to extend the side extensions 22 quite to the extreme width.

Fig. 25 illustrates one bridge embodiment of the invention at the installation stage as the internal plate surface 1 of a bridge opening 93 is being coated with shotcreting. The question can be e.g. about a rim bridge for pedestrian and bicycle traffic or a culvert for the passage of water. The shaped profiles of profile plate 1 are arranged in the direction of the cross-section for giving the structure as much rigidity as possible in that direction against various loads. In principle, fig. 11 can also depict a large subway for vehicle traffic. The same way it is even possible to build a tunnel-shaped noise barrier over a traffic route.

Fig. 26 shows a horizontal section along the line XII-XII in fig. 25. This illustrates more clearly the valley regions 2 of a profile plate 1, in which a concrete spray 4 most readily penetrates. A concrete mass supply pipe 5 is shown in principle. Prior to coating the inside it is preferable to shotcrete the outside of a structure with a concrete layer 8 before an external loading is added to the structure. The rim and culvert structures are primarily subjected to loads of compressive forces, so the concrete layers 6 and 8 are especially capable of taking up these stresses. In a conventional corrugated tube culvert, which is made of steel sheet, all stresses must be received on steel plates. Thus, the thickness of steel sheet becomes great and increases the costs. In the embodiment of the invention, the profile plate can be very thin indeed and, hence, it is inexpensive. During the spraying operation, for example, it is possible to place under the concrete layers some various devices, such as electric cables or other wires 68 so that they will be hidden below the finished structure. The final surface can be made e.g. flat 9. In view of securing the concrete layers 6, 8 coated on different sides, it is preferable to employ meshes 10 fixed by means of a joint profile 32 on both sides of profile plate 1.

Fig. 27 shows in principle one bridge cross-section of the invention. A profile plate 1 shaped as a bridge-bearing structure, e.g. a box beam, is first coated on the inside e.g. with a shotcrete layer 6 for increased strength. After this layer 6 is set, a profile plate 1 above the box is fitted crosswise in position. At the same time it is possible to effect the reinforcement of the top section by means of an external shotcrete layer 88. After this is set, a bridge deck 80 can be cast by using e.g. cast concrete 99. Finally, the outside of the bottom section can be coated with a shotcrete layer 8. Between the outside surface layers 88 and 8 may remain a construction joint 87. If desired, it is possible to provide the bridge structure with upright strut means also in the middle of the box.

Claims

1. A method for the fabrication of a bridge as a composite structure, by combining a profile plate (1), generally a steel profile plate, and concrete, c h a r a c t e r i z e d by the steps of

- placing the profile plate (1) at a bridge building site and pre-assembling the profile plate into a configuration corresponding to a bridge structure;
- spraying concrete (4) onto said profile plate (1) and securing said profile plate and sprayed concrete as a composite structure by utilizing securing means; and
- effecting said spraying of concrete (4) step by step and layer by layer by allowing the layers to set at least partially between the spraying steps.

2. A method as set forth in claim 1, c h a r a c t e r i z e d by placing a thin profile plate (1) of steel at the building site of the bridge and spraying a first layer of concrete onto the steel profile plate, allowing the first layer to set before continuing the spraying, and thereafter spraying at least a second layer of concrete onto the first layer.

3. A method as set forth in claim 1 or 2, c h a r a c t e r i z e d by placing reinforcing irons or steels between the layers of sprayed concrete.

4. A method as set forth in any of claims 1 - 3, c h a r a c t e r i z e d by spraying concrete (4) onto both surface of a profile plate (1).

5. A method as set forth in claim 3 or 4, c h a r a c t e r i z e d by spraying concrete (4) of different quality into different layers.

6. A method as set forth in any of claims 1 - 5, c h a r a c t e r i z e d in that the concrete (4) to be sprayed comprises fibrous concrete or light concrete, i.e. mixed with fibers or porous granules.

7. A method as set forth in any of claims 1 - 6, c h a r a c t e r i z e d in that said profile plate (1) is fitted with a mesh (10) for spraying concrete (4) thereon.

8. A method as set forth in claim 7, c h a r a c - t e r i z e d in that said mesh (10) is secured at least to valley regions (2) formed on profile plate (1).

9. A method as set forth in claim 7 or 8, c h a r a c - t e r i z e d in that the ends of mesh (10) are placed in recesses (14) formed on profile plate (1).

10. A method as set forth in claim 7 or 8, c h a r a c - t e r i z e d in that said mesh (10) is secured to profile plate (1) by pressing the profile around a portion of mesh (10).

11. A method as set forth in claim 1, c h a r a c - t e r i z e d in that said securing means include a fold (22; 31) or ragged edge perforation of the profile plate (1).

12. A method as set forth in claim 11, c h a r a c - t e r i z e d by shaping the fold (22) of the profile plate to have a lateral extension with varying width.

FIG. 1

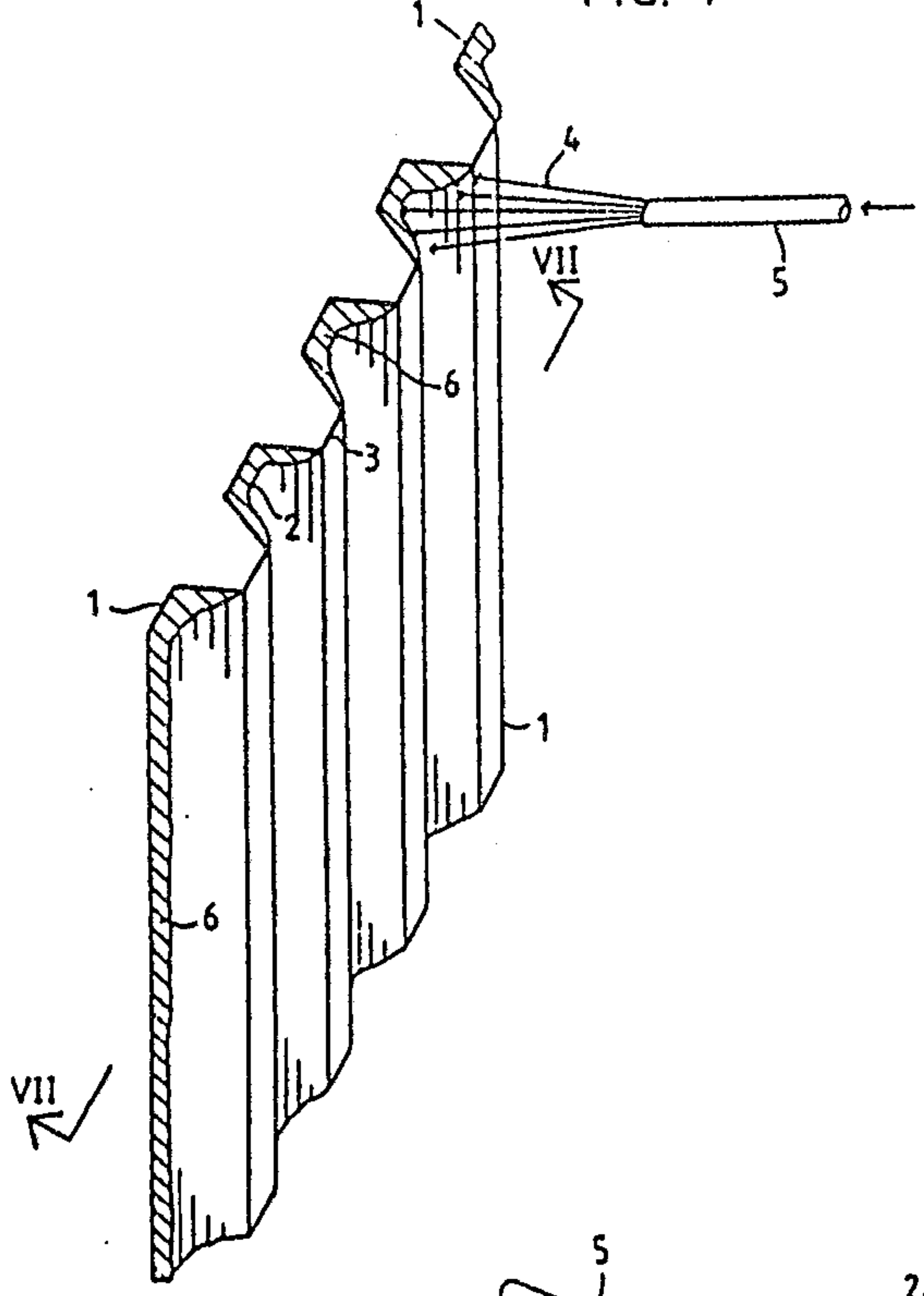

FIG. 2

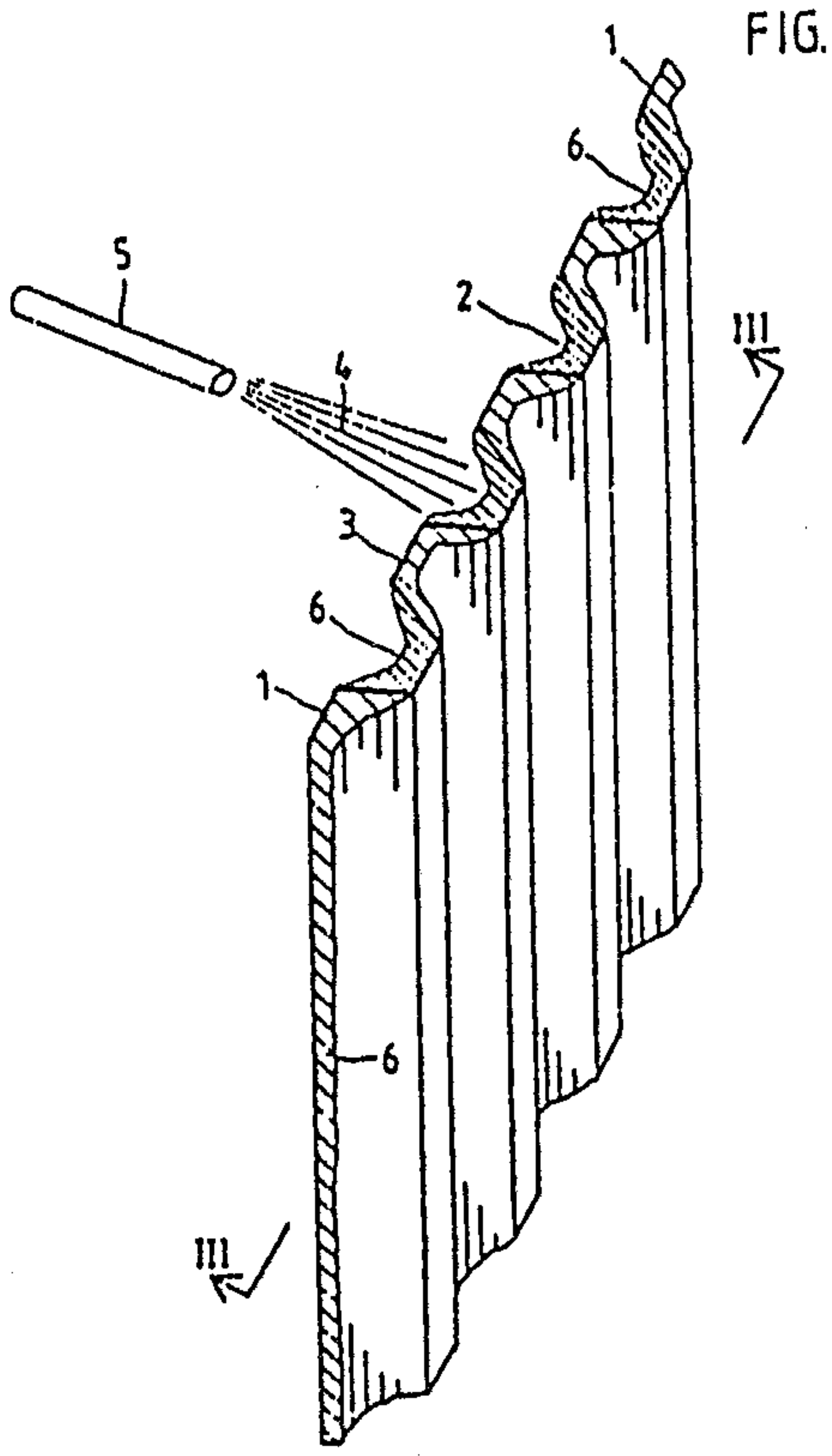

FIG. 3

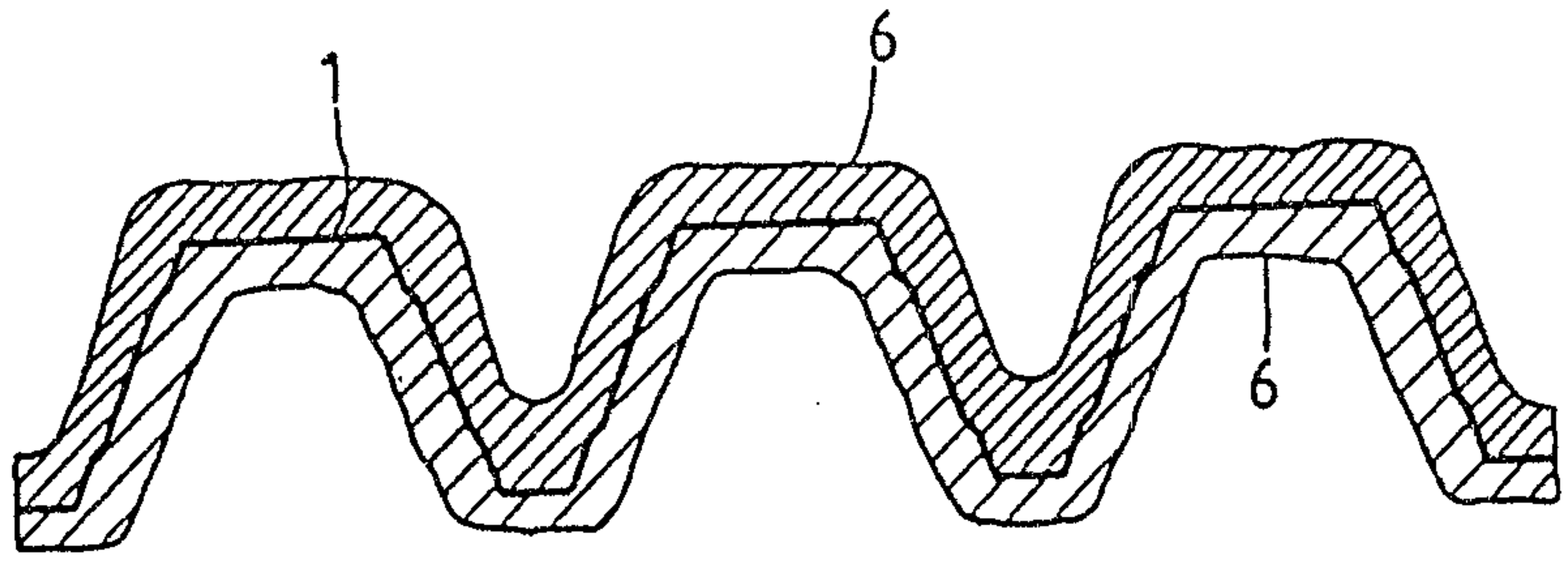

FIG. 4

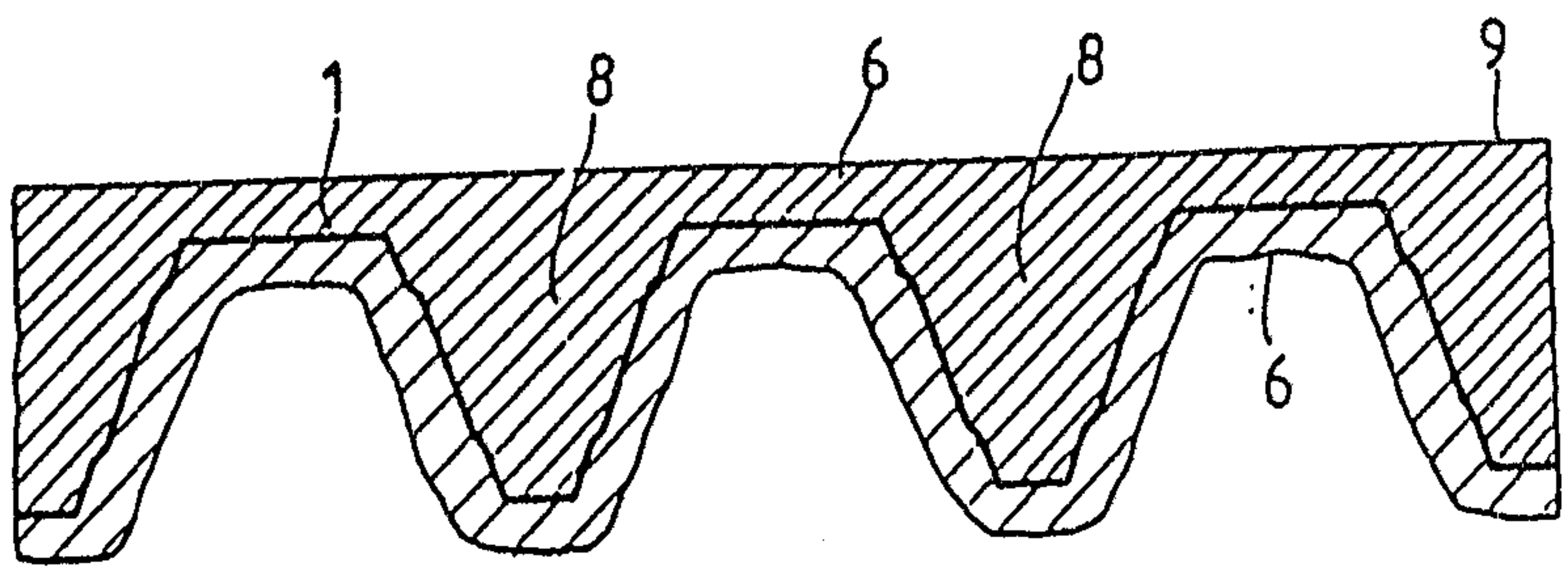

FIG. 5

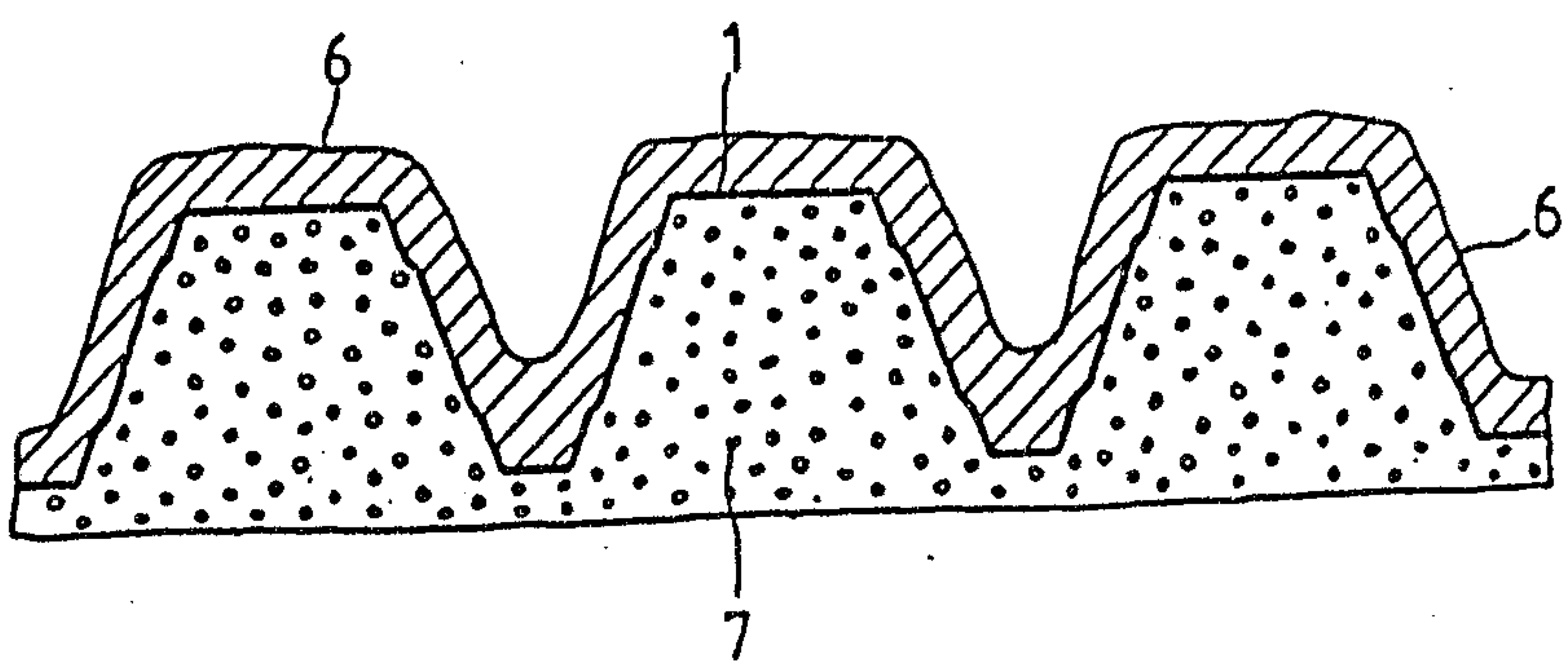

FIG. 6

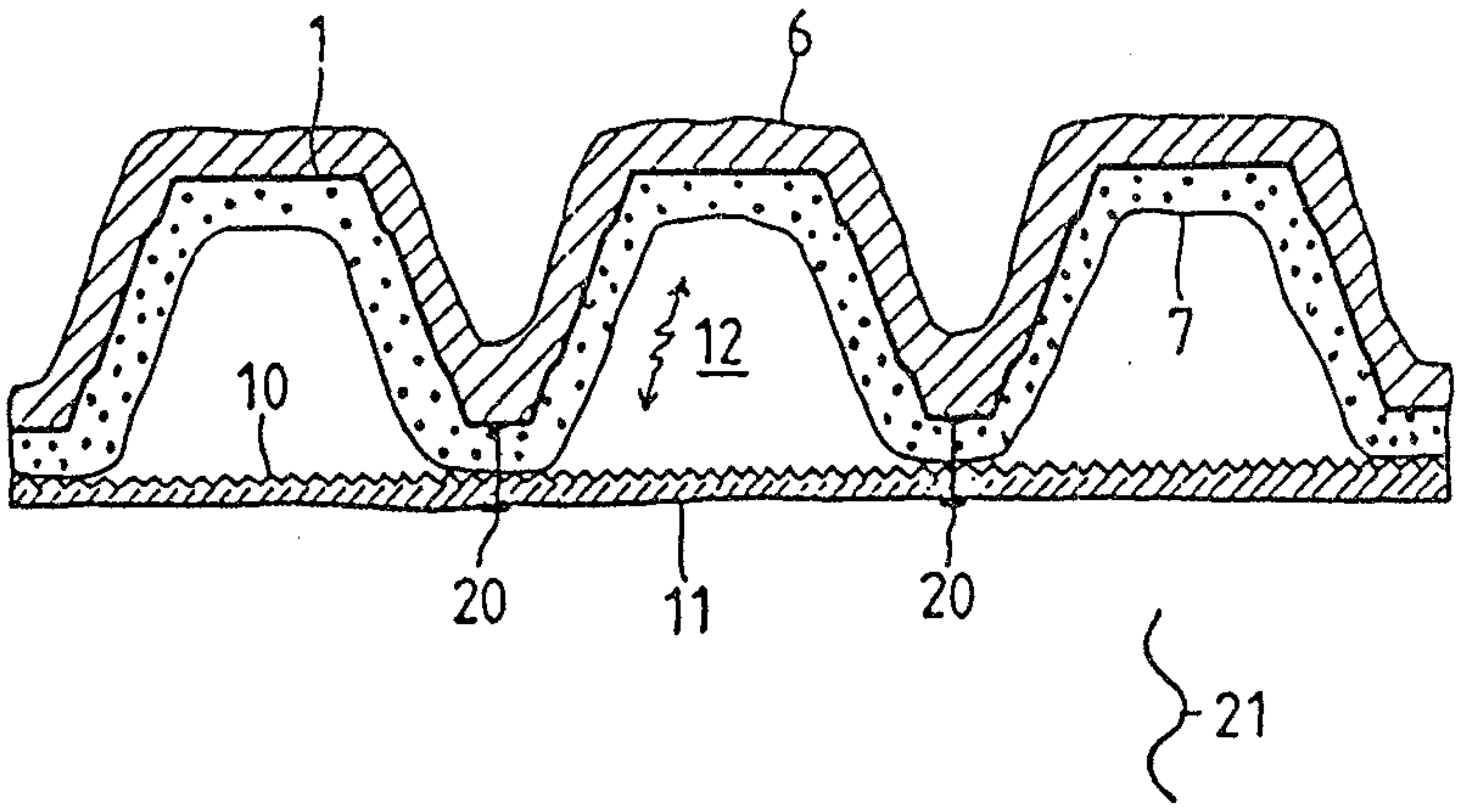

FIG. 7

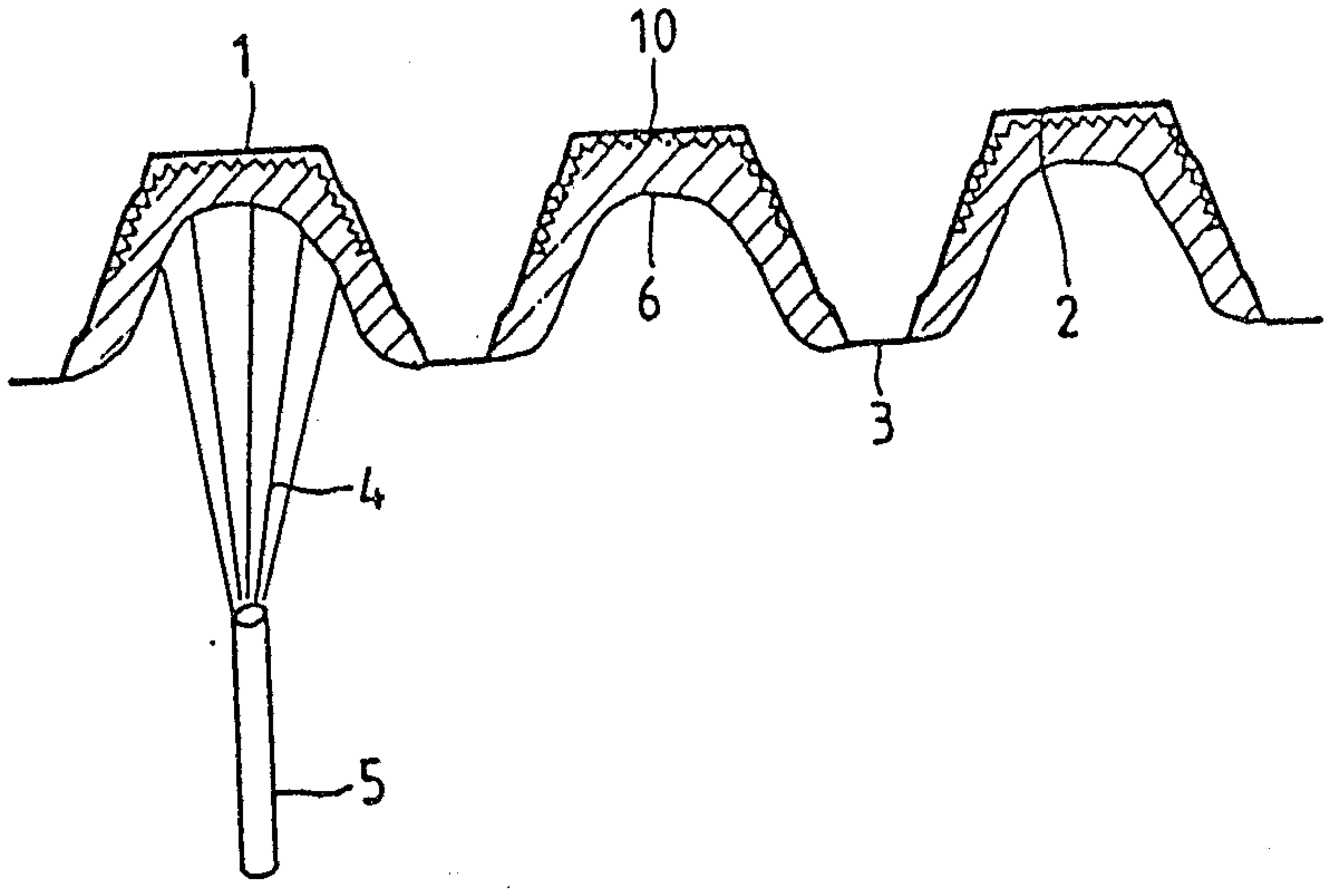

FIG. 8

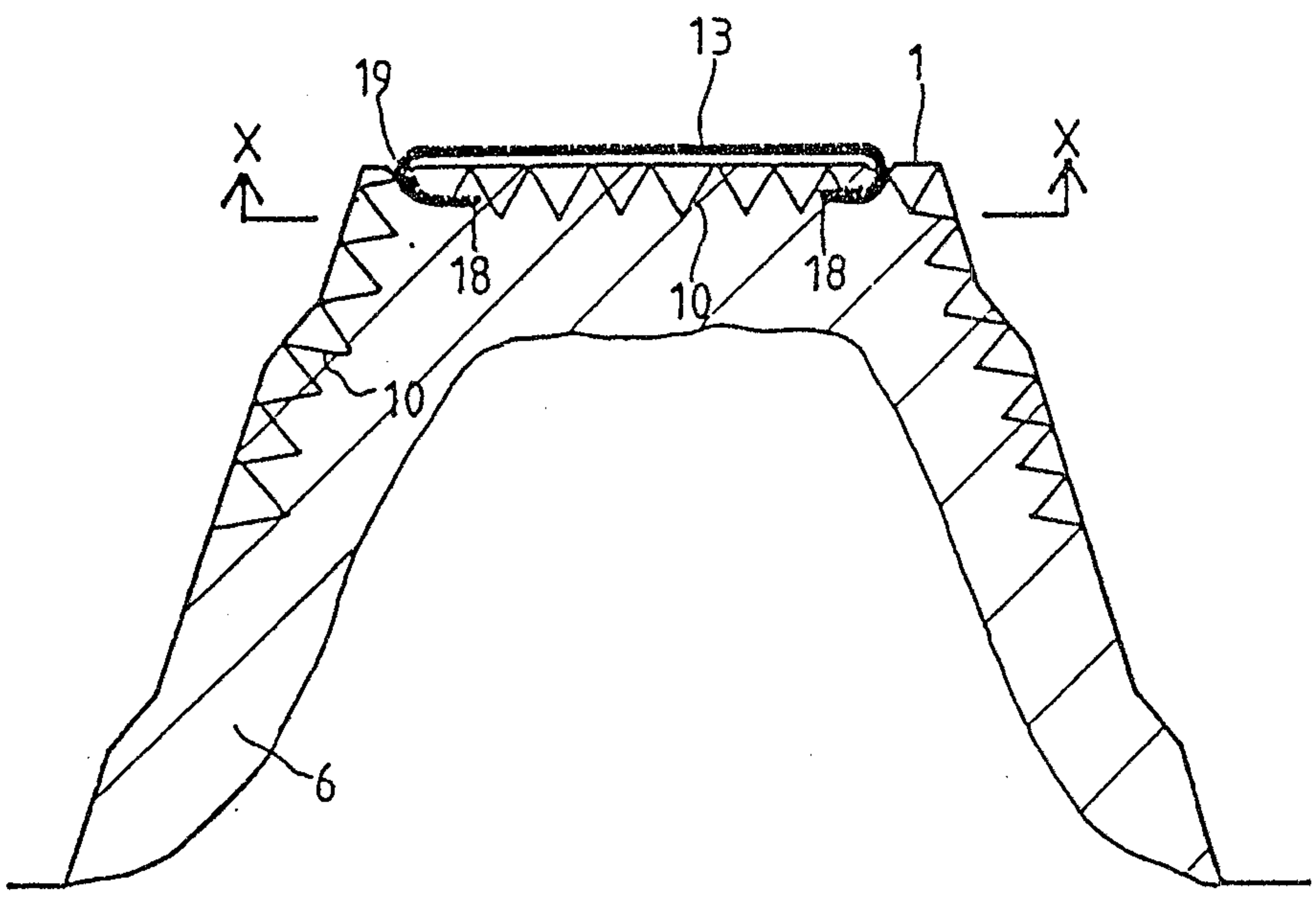

FIG. 9

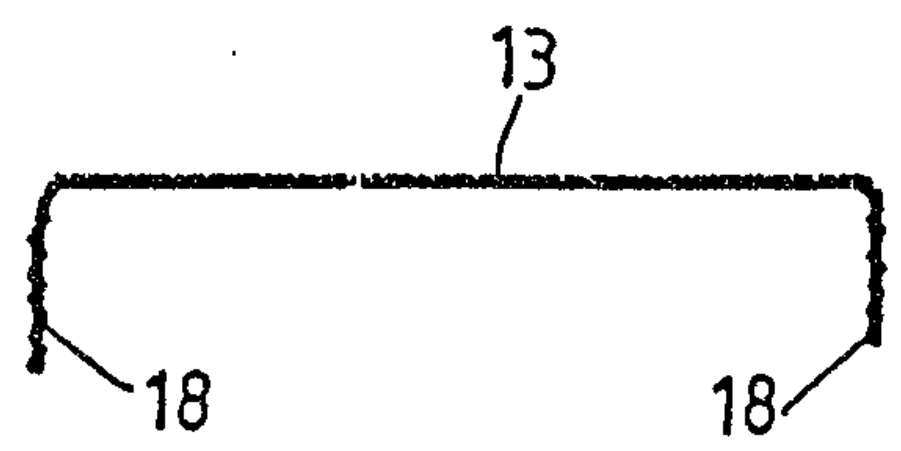

FIG. 10

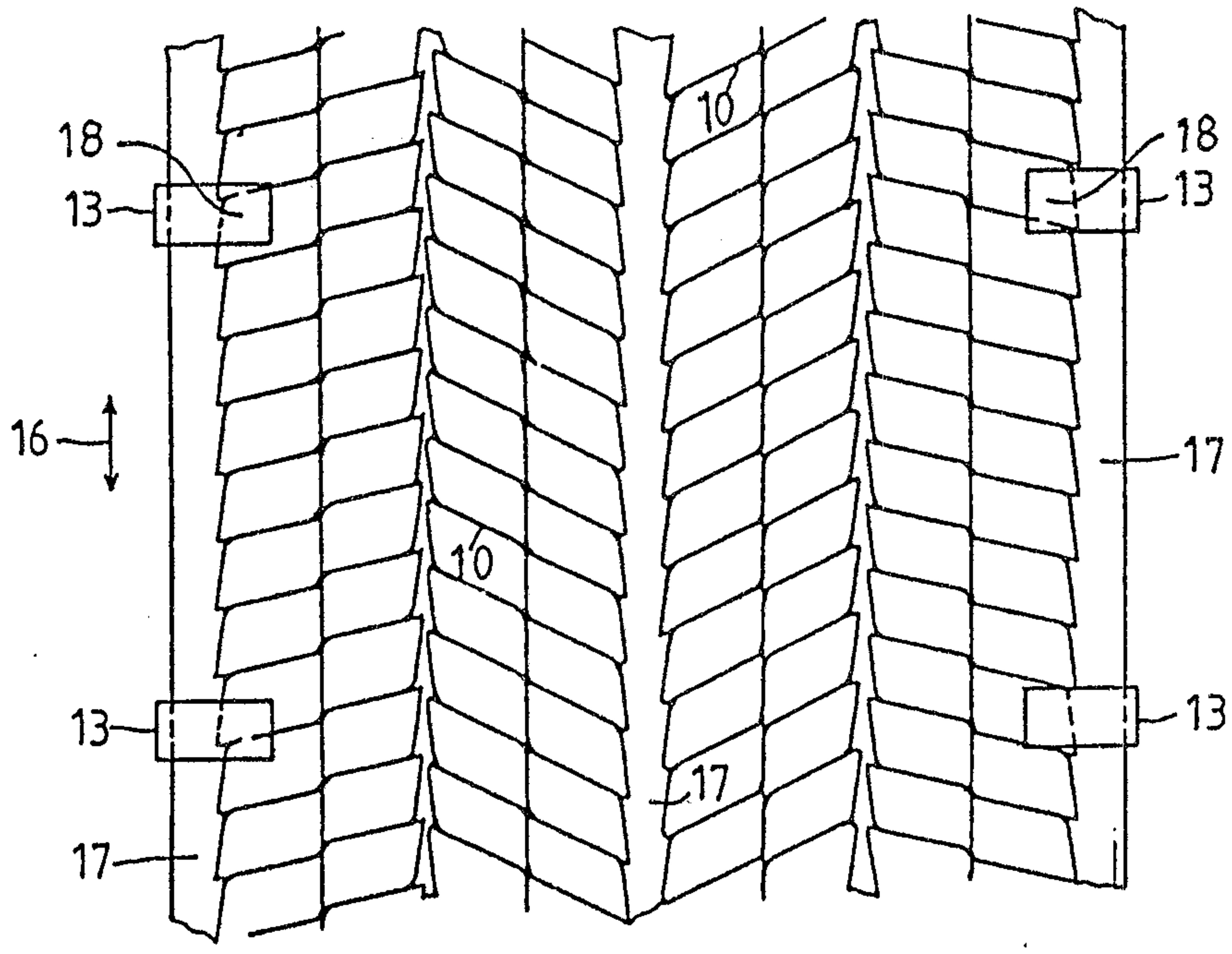

FIG. 11

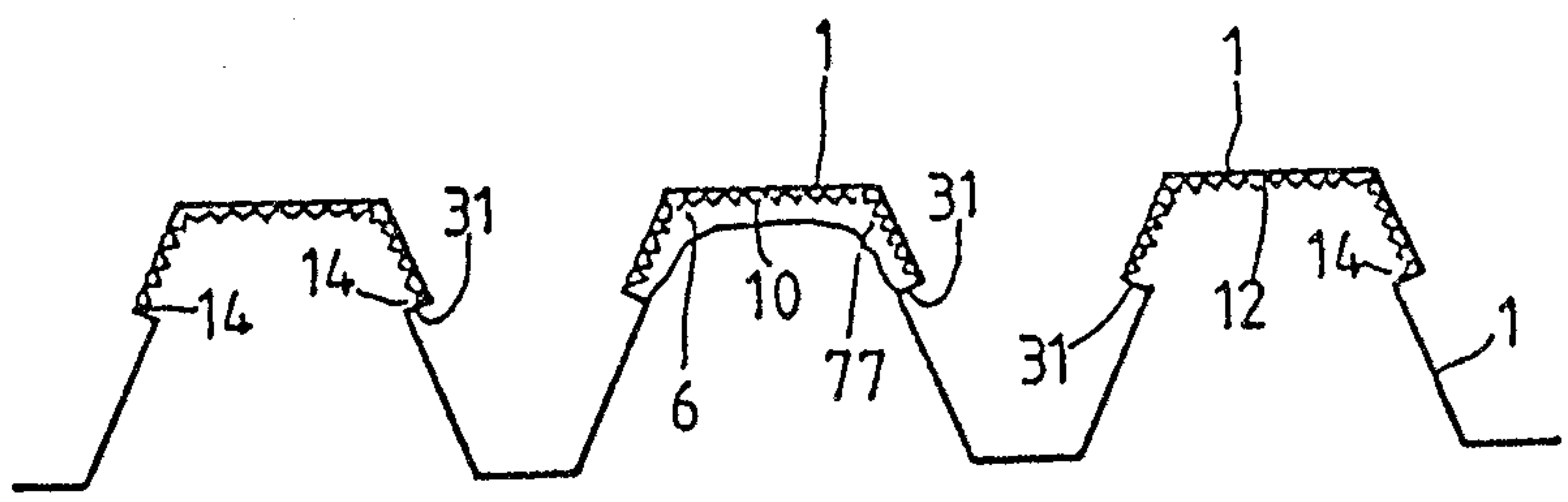

FIG. 12

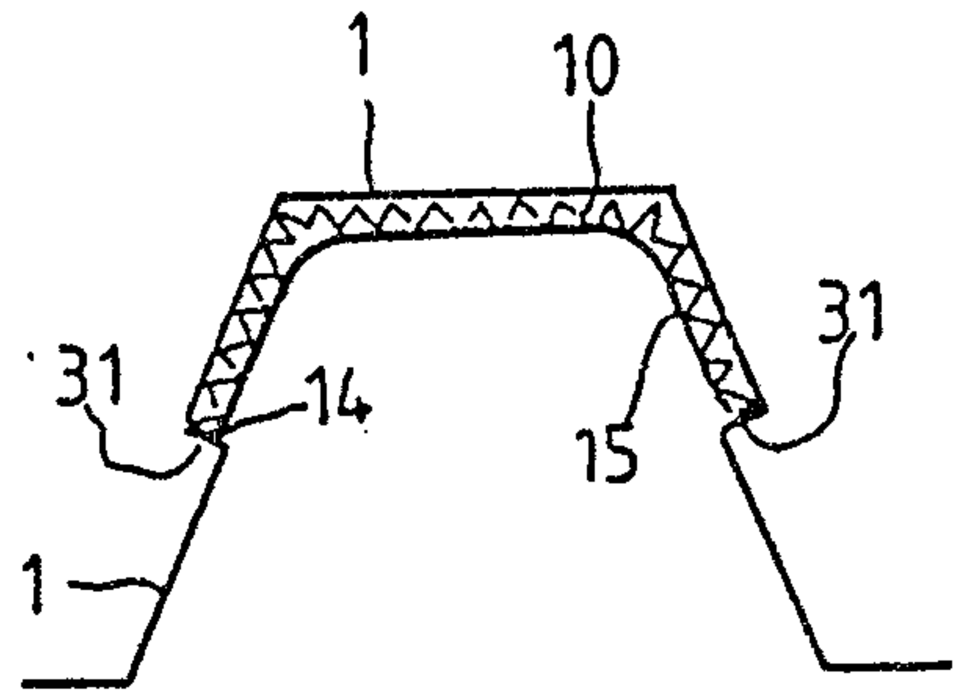

FIG. 13

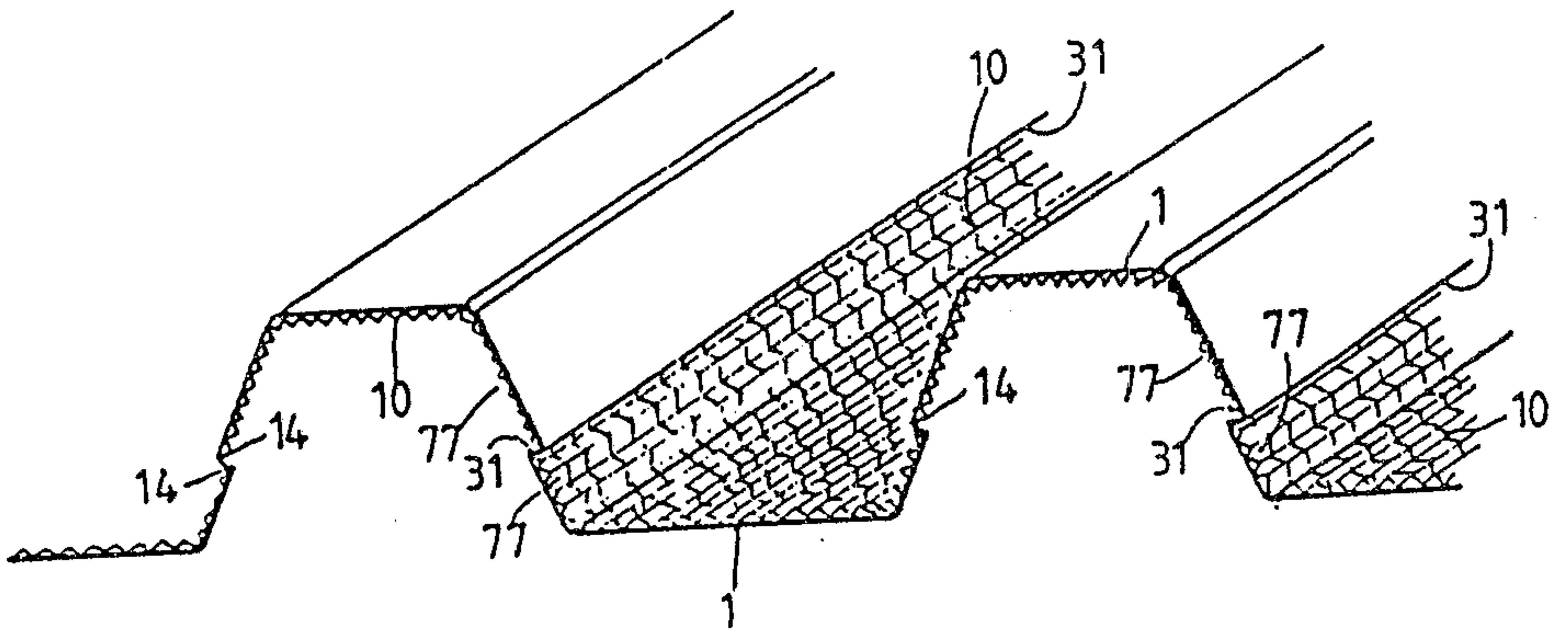

FIG. 14

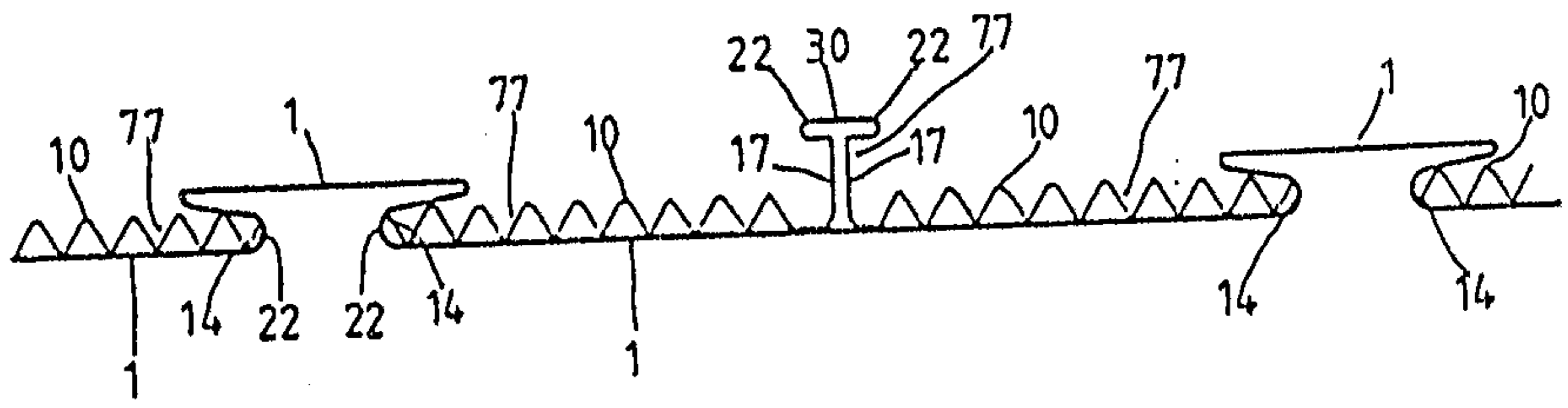

FIG. 15

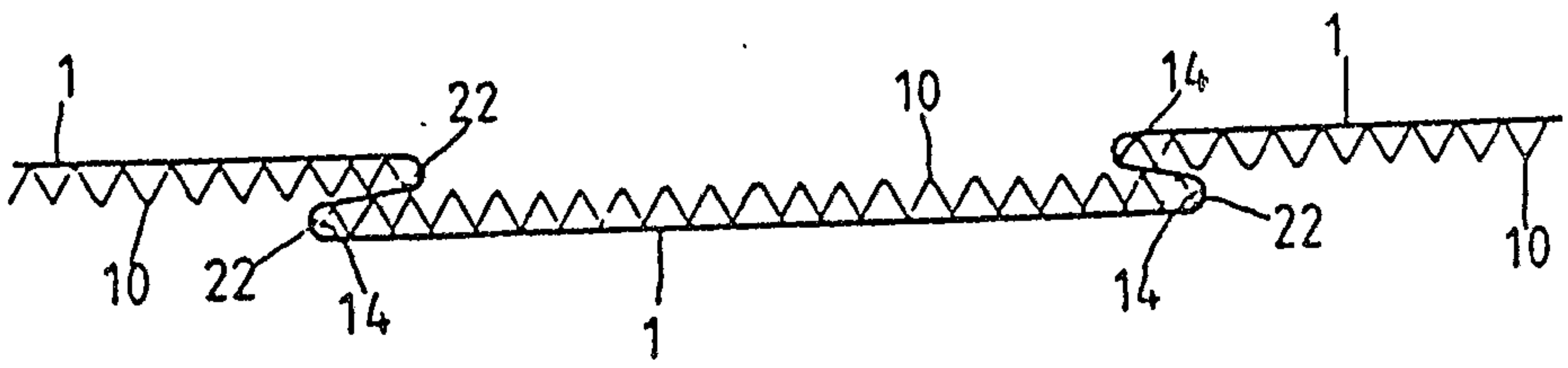

FIG. 16

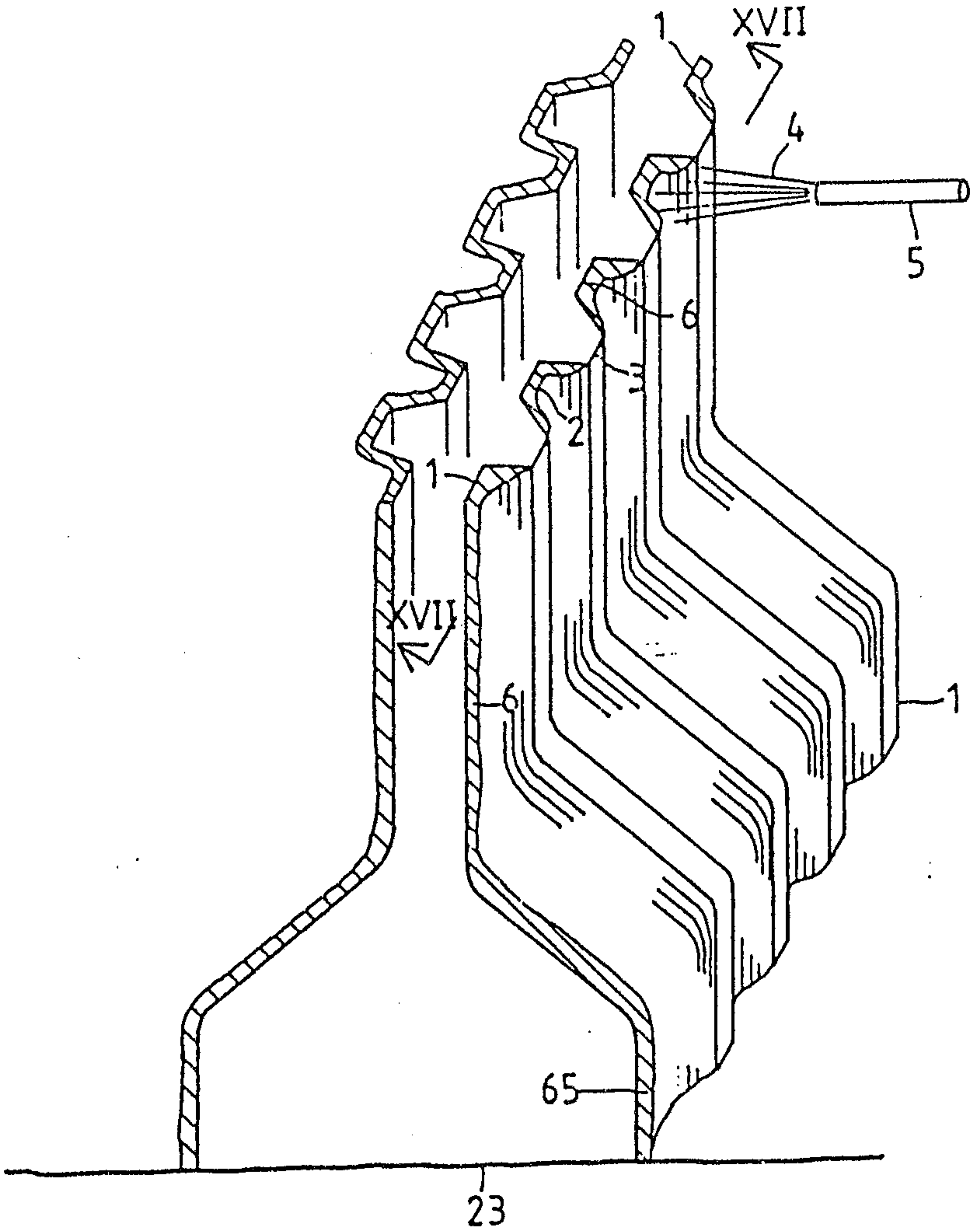

FIG. 17

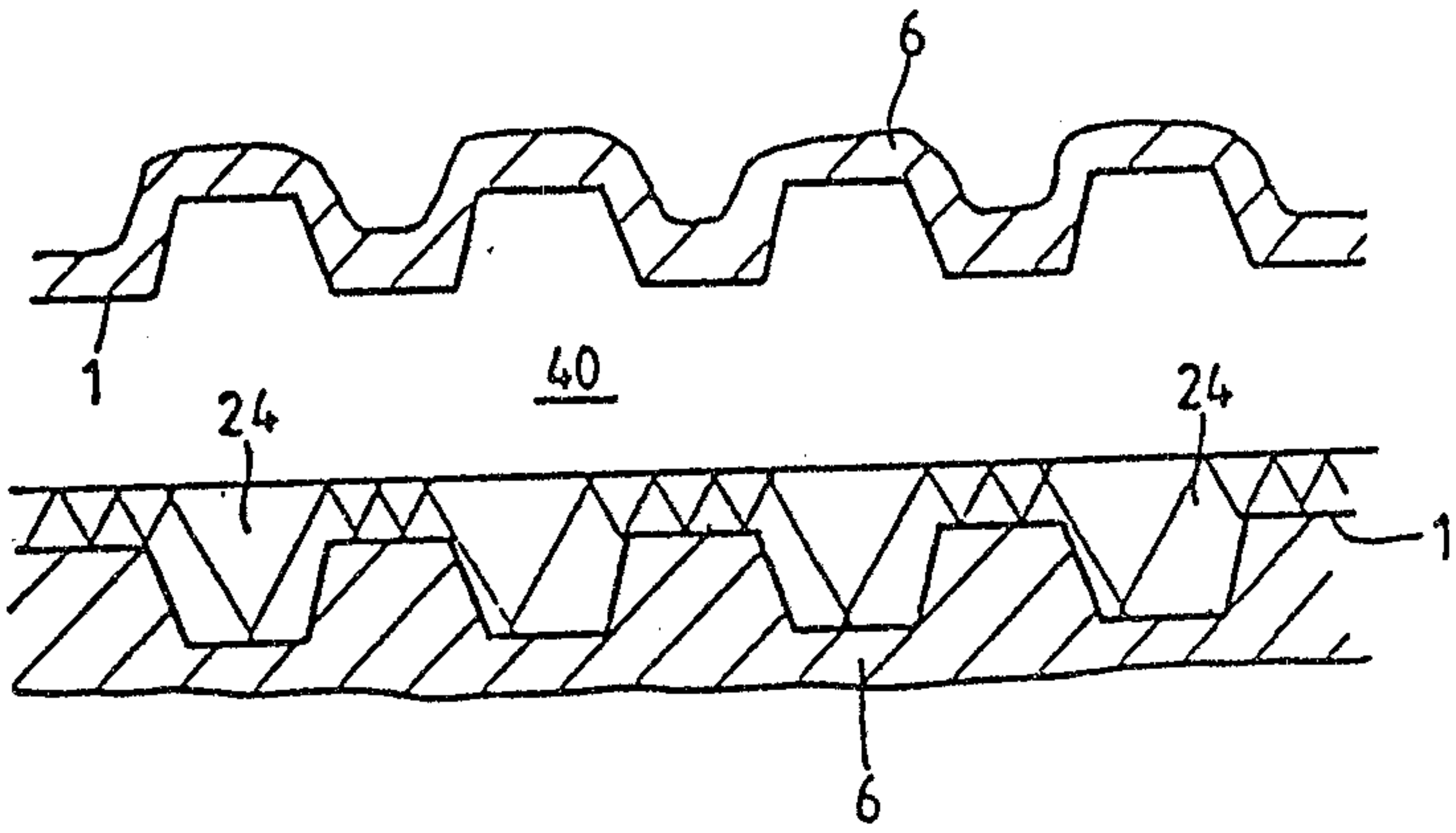

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FIG. 18

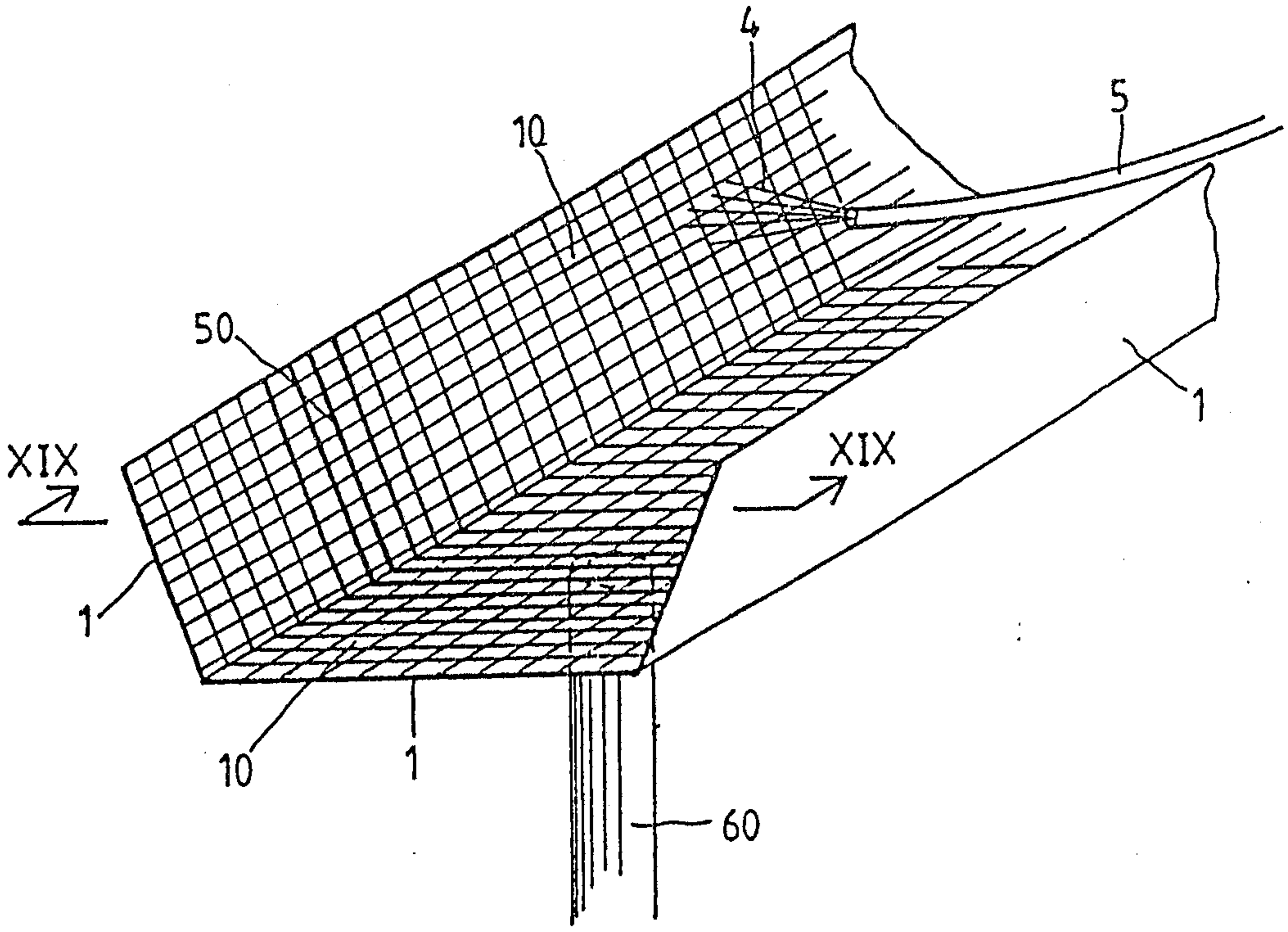

FIG. 19

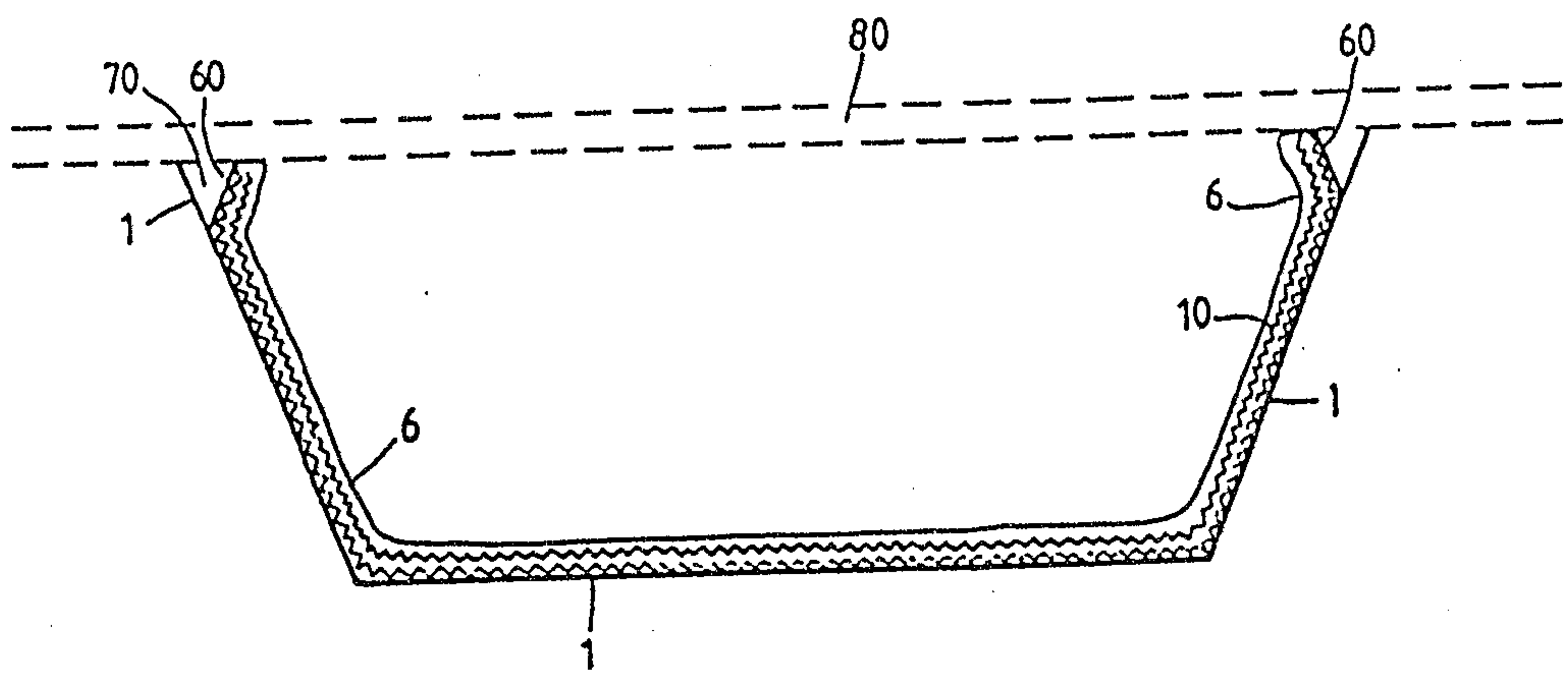

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FIG. 20

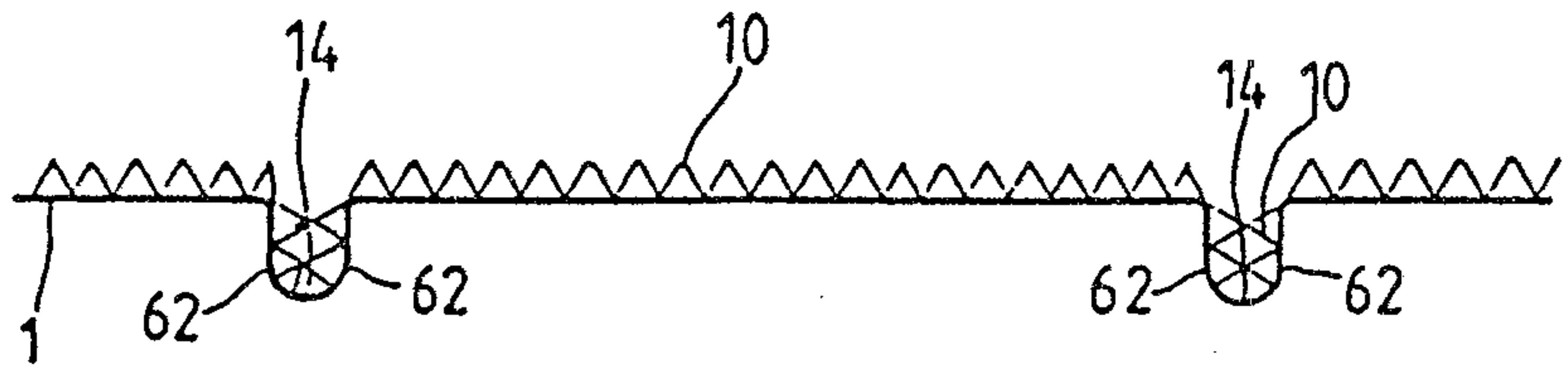

FIG. 21

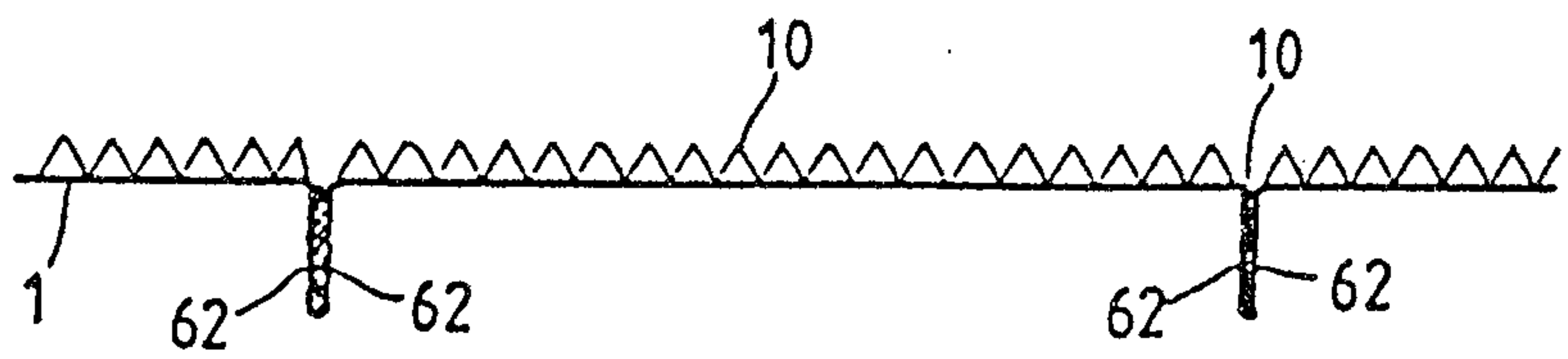

FIG. 22

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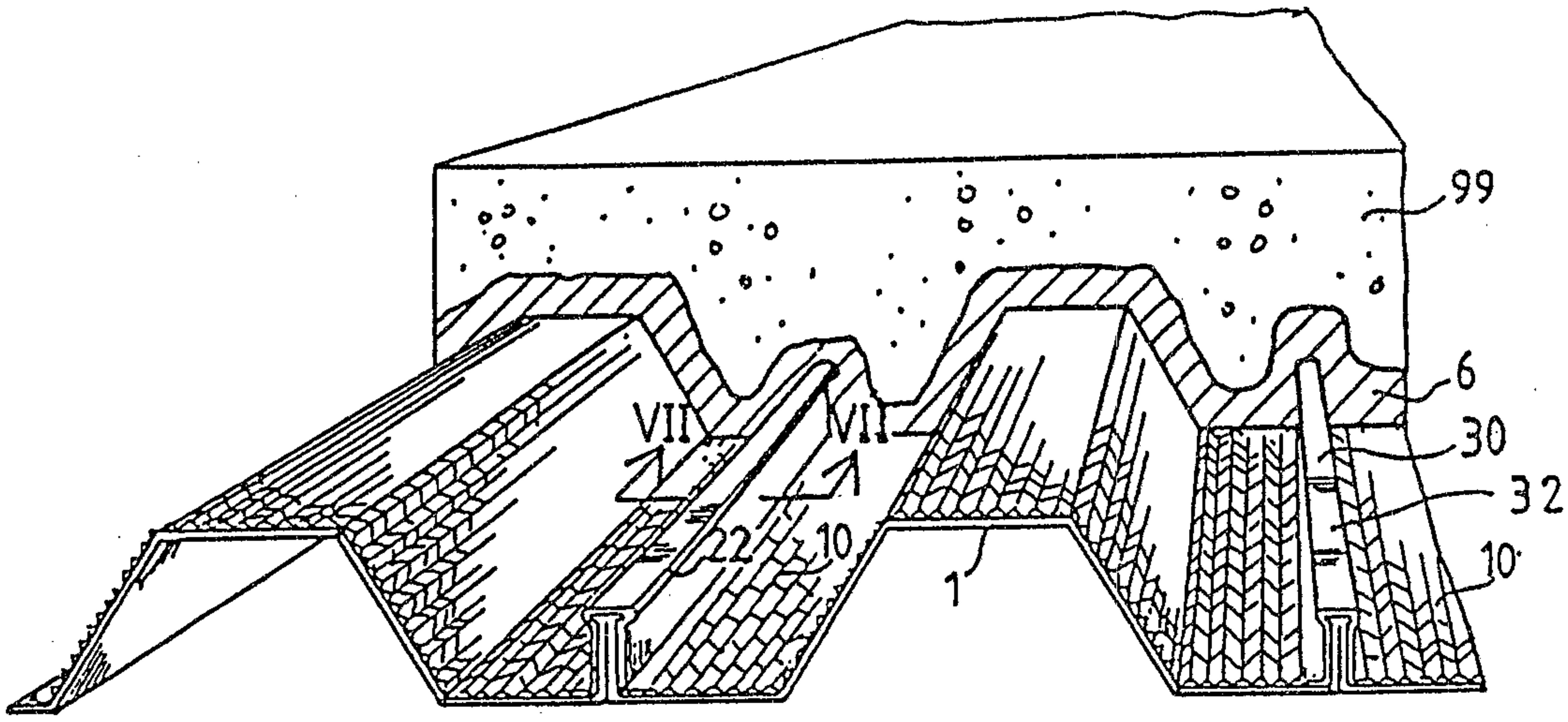

FIG. 23

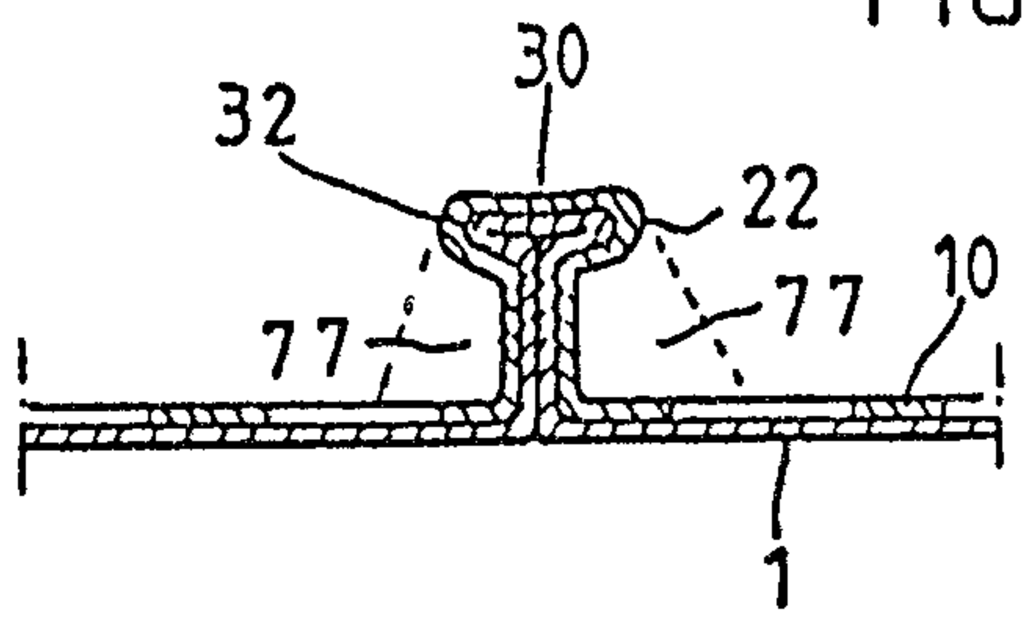

FIG. 24

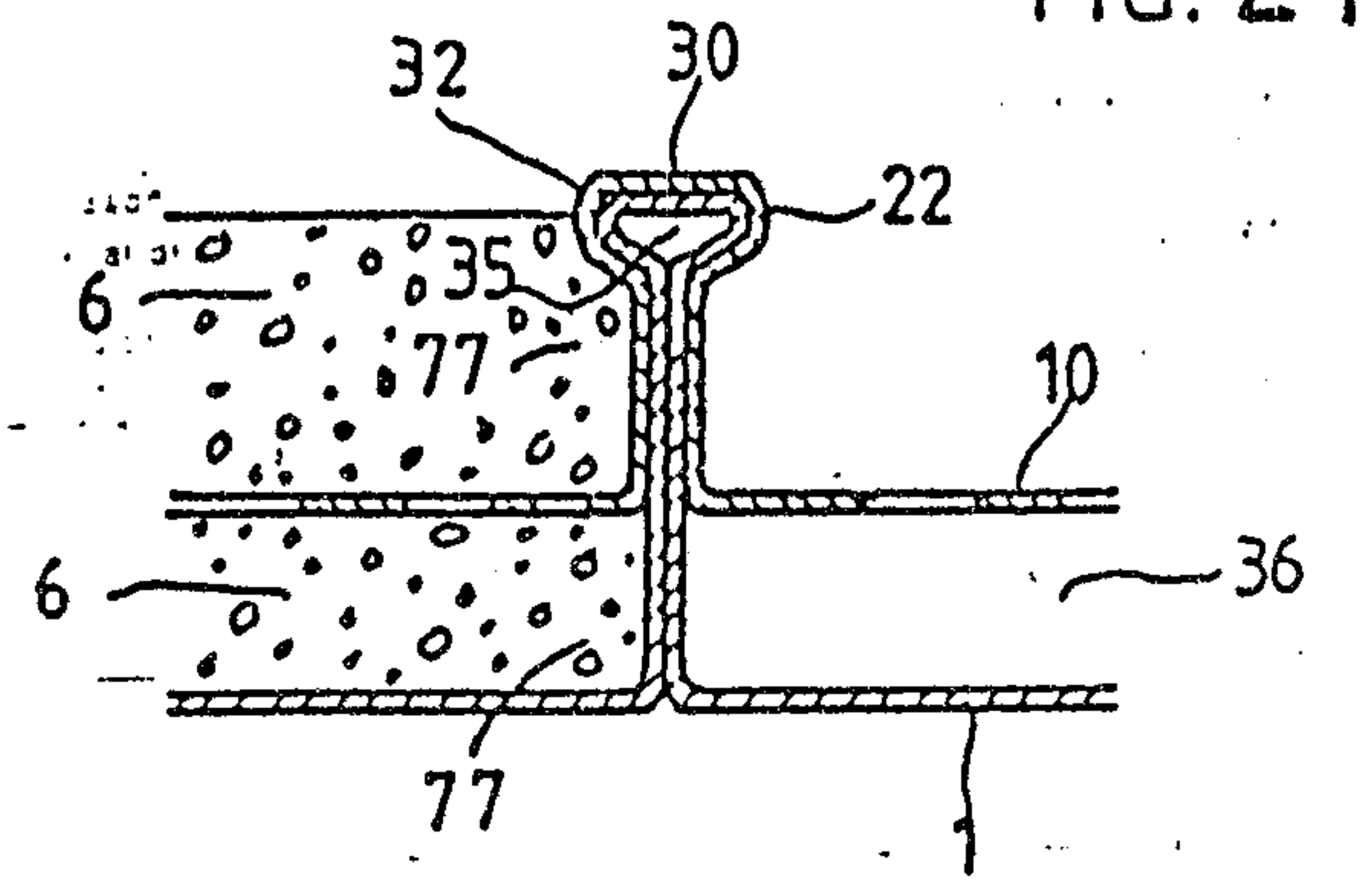

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FIG. 25

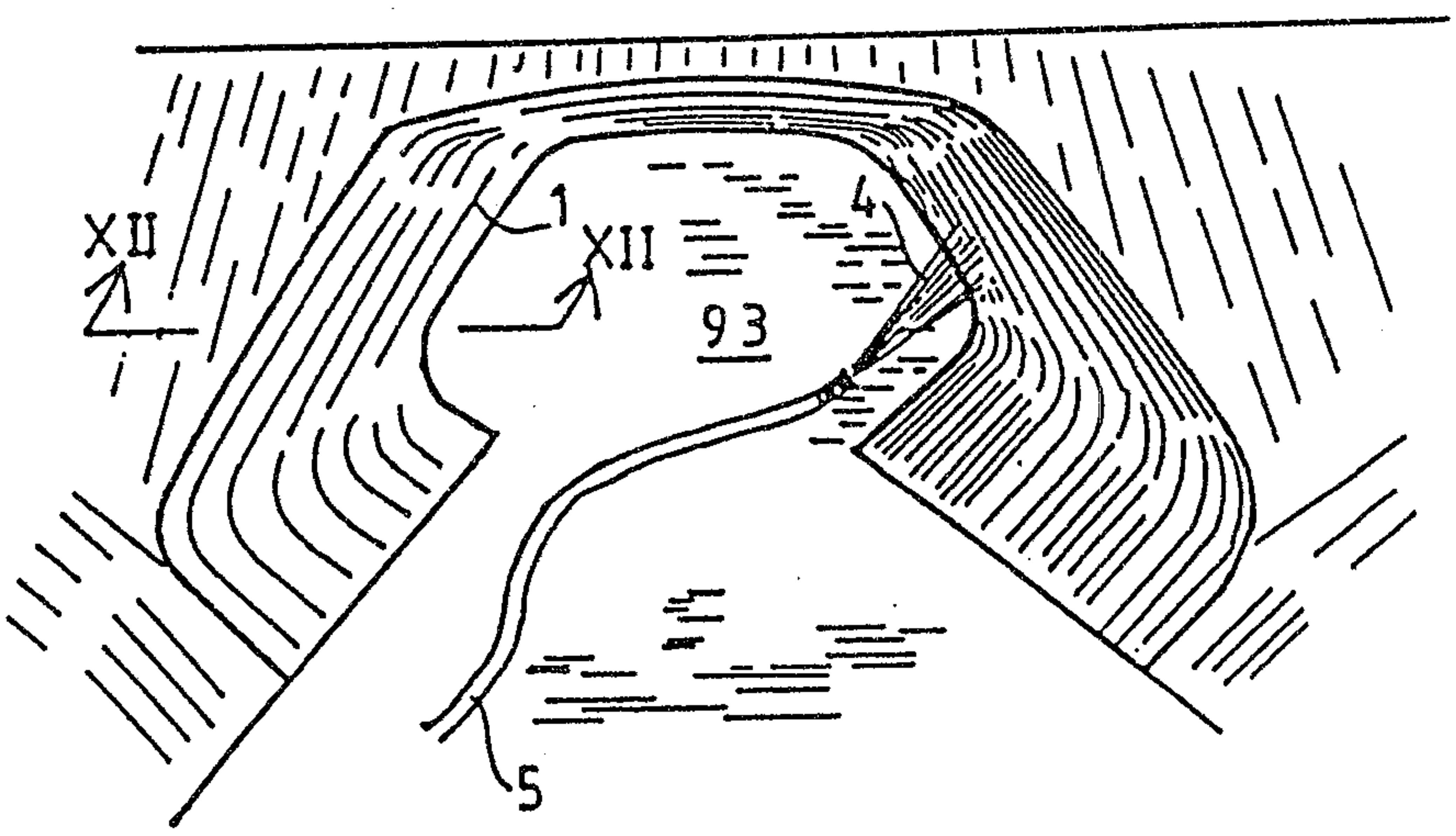
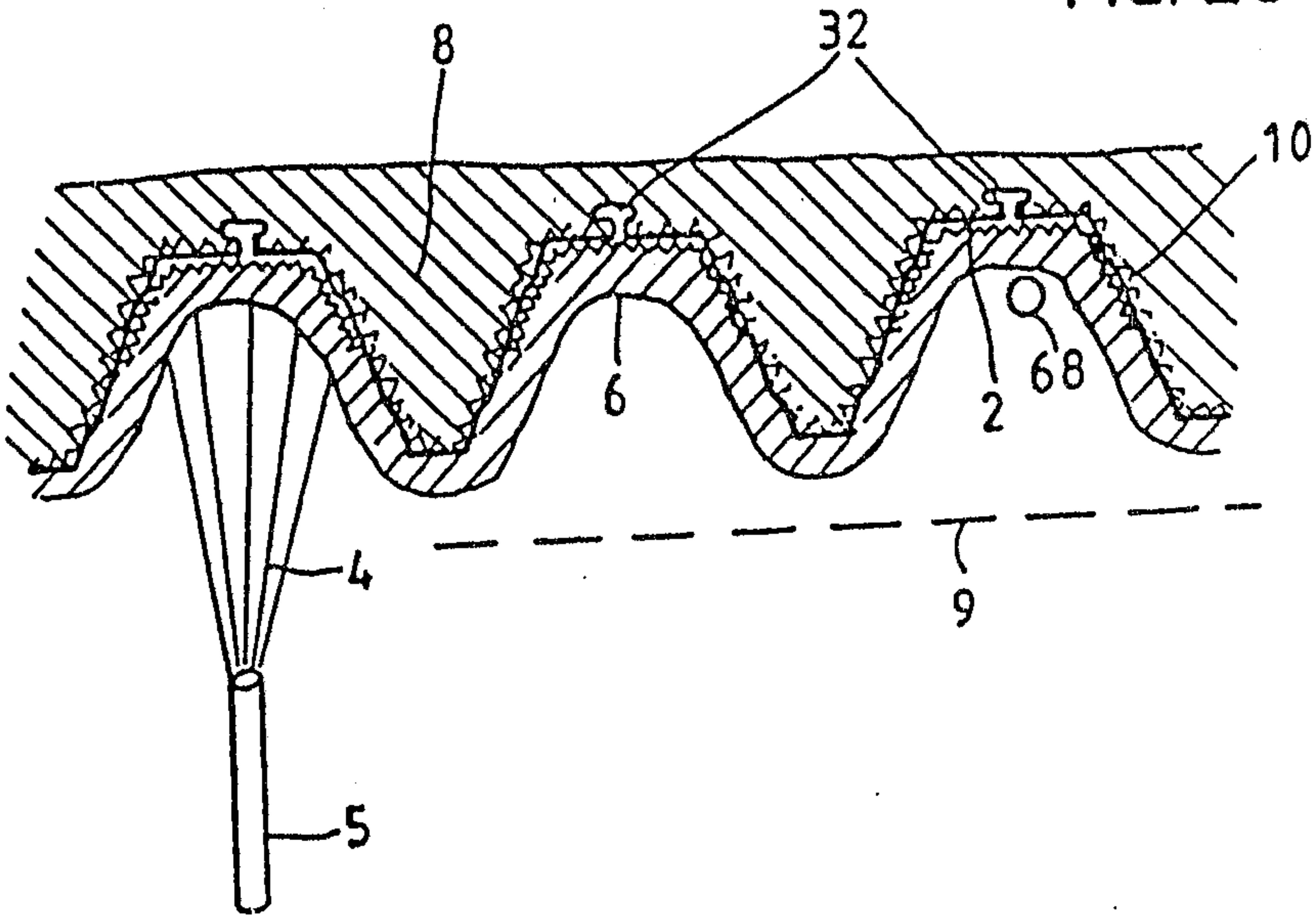


FIG. 26



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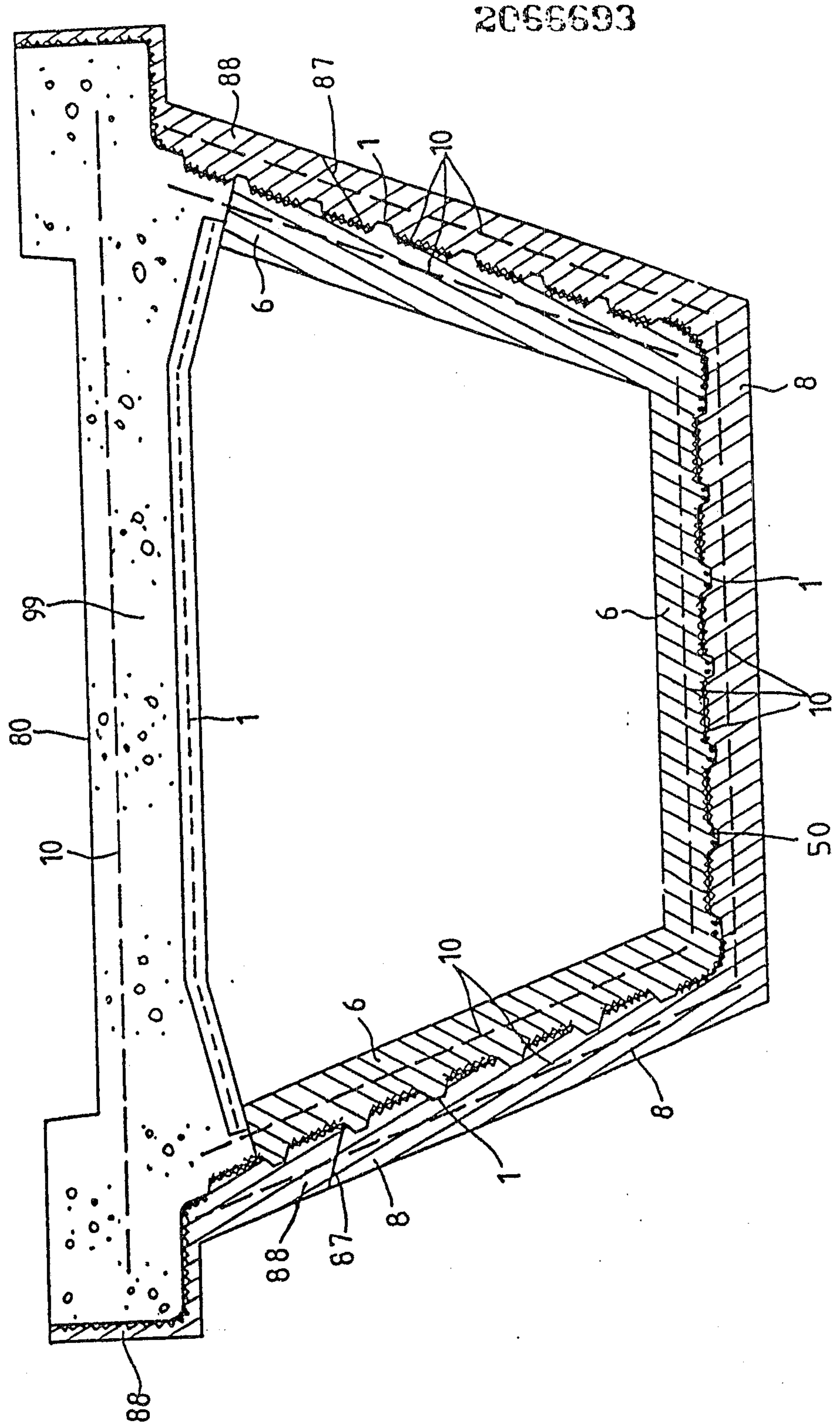

FIG. 27