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(54) **Joint structure and noise barrier**

(57) A concrete joint slab structure comprising a first part (1) cast in advance, one surface thereof being provided with several parallel ridges (2), and a second part cast on top of said first part, extending into the grooves

between the ridges of the first part. The ridges (2) are provided with a portion that is narrower than the outer portion thereof. The slab can be used also in a noise barrier consisting of a compact load-bearing concrete layer and a more porous noise absorbing concrete layer.

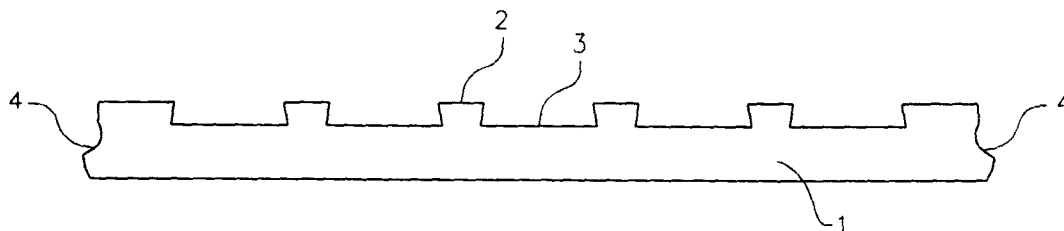


Fig. 1

Description

Technical Field

The present invention concerns a concrete joint slab structure comprising a first part cast in advance, one surface thereof being provided with several parallel ridges, and a second part cast on top of said first part, extending into the grooves between the ridges of the first part.

The present invention can also be applied when building a noise barrier comprising pillars and panels supported by means of said pillars. A panel suitable for being used in such a noise barrier consists of a compact load-bearing concrete layer and, engaged thereto, a more porous noise absorbing concrete layer, the outer surface thereof being provided with grooves.

Background Art

A so called joint slab, in other words, thin-shell slab structure is widely used in Finland and in other countries, in floor structures of buildings. The structure can be normally reinforced or pretensioned.

The structure consists of factory-made concrete elements and of a surface structure cast on the site. The bond between the element and the cast on the site is usually ensured by means of trusses or corresponding reinforcements, which, however, cause additional costs and make the handling more complicated.

A hollow core structure, in general, requires additionally a provisional supporting by means of which the load bearing capacity of the slab is secured for the loading during the casting.

Noise barriers for decreasing the noise of the traffic on residential or other areas nearby a road are used by the sides of highways, especially by the sides of motor ways. The noise barriers are either noise reflecting or noise absorbing. Noise barriers made of concrete are in general noise reflecting and those of steel are noise absorbing.

Also noise absorbing noise barriers made of concrete, provided with a noise absorbing surface made of porous material facing towards the road, are known in the art. The surface of the panels of the barrier is provided with recesses or grooves. The recesses or grooves increase the absorbing surface and also increase the absorption of the acoustic waves.

The porous structure of the absorbing concrete layer is provided by using light aggregate of the concrete or by batching it so that it is porous.

Noise absorbing concrete panels have been manufactured by mould casting first an absorbing layer of porous concrete mass and then a load-bearing layer of compact concrete on top of it. A maximum length of 6 m of the panels has been achieved by using this method. When building a noise barrier, both ends of each panel must be equipped with a pillar and a foundation in the

ground beneath it. The shorter the panels to be used are, the more foundation parts are required.

The pillars to be used have usually an H-formed cross-profile, whereby the ends of the panel are fitted between the two lips of the pillar, where they stay in place.

Disclosure of Invention

A joint slab structure in accordance with the present invention is characterized in that the ridges in the first part are provided with a portion that is narrower than the upper portion thereof.

Comprehensive testing has shown that especially with loads in dwelling and parking houses, the above mentioned truss reinforcement in the joint structures of intermediate floors is not necessary for transferring the loads between the surface cast and the slab. In the structure in accordance with the invention, the bond is based on the roughness and profile of the surface.

The thickness of the slab as well as the number and dimensions of the profiles can vary flexibly according to the load. The most common heights are from 100 to 200 mm.

In order to increase the bond between the upper and lower portion of the floor structure, the profiles of the lower slab are preferably formed as "swallow tails". Thereby the minimum bond will be also ensured in situations where the horizontal bond is weakened by the circumstances or by imperfections.

The side edges of the lower slabs can be provided with longitudinal lift slots. The slabs, as well in the factory as on the site, can be lifted with lift tongs and no separate lift eyes are required. This arrangement also facilitates the handling and storage in different stages, while there are no projecting parts on the upper surfaces of the slabs.

The slabs are manufactured on long pretensioning beds by utilizing the pretensioning technique. As main reinforcement there is longitudinal pretension, but if necessary, also transversal reinforcement can be added thereto.

Due to the chosen profile, the rigidity of the lower slab compared with that of the traditional solutions is better, and thus, the provisional supporting can be significantly reduced.

The product can be manufactured e.g. by using the method and equipment described in international publication WO 95/29799. This manufacturing method is characterized in that it is possible to use stiff concrete masses with a low water-cement ratio, because even stiff concrete can be efficiently compacted with said equipment. In that way the swallow tail form can be maintained on the upper surface of the cast product during the slide casting, by using concrete that is stiff enough. The water-cement ratio can be less than 0.45, preferably between 0.3 and 0.4. When such stiff concrete mass is used, the upper surface will be rougher

when compared to less stiff mixes. This rough surface also increases the good bond between the lower and upper layers.

When the invention is applied to a noise barrier and a noise barrier panel, the load-bearing layer is a pretensioned slab cast by slide casting, the surface thereof to be engaged to the porous layer being provided with ridges, whereby the cross-profile of the ridges has a portion that is narrower than the outer portion thereof. The porous layer is engaged to the load-bearing layer via its mass cast between the ridges of the load-bearing surface.

The load-bearing portion of the noise barrier panels is cast by slide casting on a long pretensioning bed using thereby longitudinal pretensioned steels. When casting the load-bearing portion, longitudinal ridges with a swallow tail cross-profile are formed on the upper surface of the load-bearing portion.

When the load-bearing portion is still lying on its pretensioning bed, a porous layer is cast, also by slide casting, on top of the load-bearing portion, and longitudinal ridges are formed on the upper surface of the porous layer during the cast.

The two-layer noise barrier slabs cast by slide casting are cut by sawing into panels, the end faces thereof being flat planes. The panels are attached to pillars behind the barrier, against the surface of the pillars facing towards the road. In that way also the pillars of the barrier are simpler and less expensive than those of structures known in the art.

By using pretensioned slide cast elements as noise barrier panels, about a double bearing distance can be achieved compared with earlier structures, whereby only a half of the earlier number of pillars is needed, and the foundation costs of the barrier will be reduced by half.

Brief Description of Drawings

The invention and its details will be described in more detail in the following, with reference to the enclosed drawings, wherein

Figure 1 illustrates as a cross section the lower or first slab of a structure in accordance with the present invention,

Figure 2 illustrates a detail of figure 1 in a larger scale,

Figure 3 illustrates a cross section of a detail of a lower slab, lifted by lift tongs,

Figure 4 shows as a perspective view parts of a noise barrier in which slabs in accordance with the invention are used,

Figure 5 is a cross section of the noise barrier,

Figures 5a - 5c show in a larger scale details of figure 5,

Figure 6 shows a top view of a part of the noise barrier and

Figures 7a - 7c show a side, front and top view of a covering part between the panels of the noise barrier.

5 Modes for Carrying Out the Invention

In a structure in accordance with the invention, the lower or first slab 1 has been cast of concrete in advance by means of a slide casting apparatus. The upper surface of the lower slab is provided with longitudinal ridges 2, the cross section thereof having a form of a swallow tail. Thus, the cross section becomes wider from the base upwards. Grooves 3 are provided between the ridges, the bottom of said grooves being wider than the upper portion thereof. Longitudinal grooves 4 are provided on both vertical sides of the slab. The slabs are provided with conventional longitudinal pretensioning reinforcement (not shown in the drawings).

The lower slabs can be handled with lift tongs generally used for handling of concrete slabs, said tongs being fitted into the grooves 4 on both sides of the slab. Figure 3 illustrates one edge of a slab lifted by tongs 5.

As no lift eyes are necessary for the lower slabs and no trusses for securing the bond, the slabs can be easily stacked one on another for the storage and transportation.

When the lower slabs have been mounted in a building, the upper portion of the structure will be cast on top of them (not shown in the drawings).

The total thickness of the lower slab is e.g. 50 ... 200 mm, wherein the ridges cover about 10 ... 100 mm. The thickness of the upper part cast on the site can be e.g. 50 ... 300 mm. The thickness of the slab can, however, vary a lot depending on the use.

The ridges 2 increase the rigidity of the lower slab, whereby less provisional additional supports are required during the installation, than when using an equally thick slab.

Even though the bond between the parts should for some reason be incomplete after the casting of the upper part, the swallow tail engagement keeps the upper and lower parts of the structure together, when the parts are wedged against each other.

The main parts of a noise barrier shown in Figs. 4 to 7 are a panel 6 and a pillar 7. A footing element 8 and a covering part 9 can be used in addition.

The panel 6 comprises a load-bearing layer 10 and a porous layer 11. The load-bearing layer 10 has been cast by slide casting of compact concrete and it has longitudinal pretensioning reinforcements (not shown in the drawings). The load-bearing layer can be a hollow-core concrete slab with longitudinal cavities 12 or it can be a solid concrete slab. On one surface of it there are longitudinal ridges 13 with a swallow tail cross-profile. The porous, absorbing layer 11 having longitudinal ridges 14 on its outer surface and grooves between them, is engaged to the load-bearing layer. The swallow tail ridges 13 of the load-bearing layer engage the layers tightly to

each other.

The pillars 7 of the barrier are mounted on top of the foundations in the ground. A console 15 can be attached to the lower part of the pillar. The footing element 8 is supported by its ends on the consoles or corresponding of the two pillars. On top of the footing element there are from 1 to 3 panels, depending on the height of the barrier. The panels and footing are supported against the pillar by means of parts 16 fastened to the pillar by means of screw bolts 17 and nuts 18. Covering elements 9 made of sheet metal are fitted between the panels. No fixing holes are required in the panels themselves.

The pillars can be provided e.g., as illustrated in figure 4, with an inclined front face, whereby the panels are attached on them in an inclined position.

Between the panels placed one upon another, there are rubber seals 19 and on top of the uppermost panel there is a covering steel plate 20. A seal 21 is also provided between the pillar and the panel.

If desired, the both surfaces of the panels can be coloured, e.g. by using a coloured concrete or suitable coating. The plating parts can be coated e.g. by a coloured plastic or by painting.

Claims

1. A concrete joint slab structure comprising a first part (1; 10) cast in advance, one surface thereof being provided with several parallel ridges (2; 13), and a second part cast on top of said first part, extending into the grooves between the ridges of the first part, **characterized** in that the ridges (2; 13) in the first part are provided with a portion that is narrower than the outer portion thereof.
2. A joint slab structure in accordance with claim 1, **characterized** in that the ridges (2; 13) of the first part (1; 10) of the structure and the grooves between them are formed by plane surfaces.
3. A joint slab structure in accordance with claim 2, **characterized** in that the cross section of the ridges (2; 13) of the first part (1; 10) of the structure is shaped like a swallow tail.
4. A joint slab structure in accordance with any of the claims from 1 to 3, **characterized** in that the side surfaces of the first part (1) of the structure are provided with longitudinal grooves (4).
5. A joint slab structure in accordance with any of the claims from 1 to 4, **characterized** in that the first part (1) of the structure can be lifted by using the grooves (4) on the side surfaces.
6. A joint slab structure in accordance with claim 1,

comprising a compact load-bearing concrete layer (10) and engaged thereto, a more porous, noise absorbing concrete layer (11), the outer surface of the porous layer being provided with grooves (15), **characterized** in that the load-bearing layer (10) is a pretensioned slab cast by slide casting, and that the porous layer (11) is engaged to the load-bearing layer (10) via its mass cast between the ridges (13) of the load-bearing surface.

7. A joint slab structure in accordance with any of the claim 1 to 6, **characterized** in that the first part (1; 10) connected to second part is a hollow-core concrete slab.
8. A noise barrier comprising pillars (7) and panels (6) supported by the pillars, whereby a panel consists of a compact load-bearing concrete layer (10) and engaged thereto, a more porous, noise absorbing concrete layer (11), the outer surface of the porous layer being provided with grooves (15), **characterized** in that the load-bearing layer (10) is a pretensioned slab cast by slide casting, the surface thereof engaged to the porous layer (11) being provided with ridges (13), whereby the cross-profile of the ridges has a portion that is narrower than the outer portion of the same, and that the porous layer (11) is engaged to the load-bearing layer (10) via its mass cast between the ridges (13) of the load-bearing surface.
9. A noise barrier in accordance with claim 8, **characterized** in that the barrier pillars (7) between the panels (6) are located behind the barrier, facing towards the load bearing layer (10) of the panel.
10. A noise barrier in accordance with claim 9, **characterized** in that the end surfaces of the panels (6) are plane surfaces.

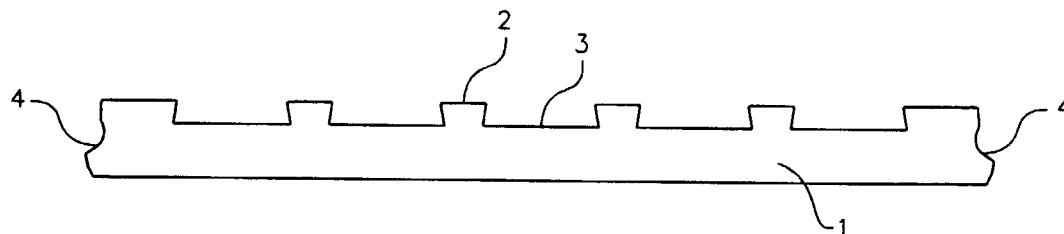


Fig. 1

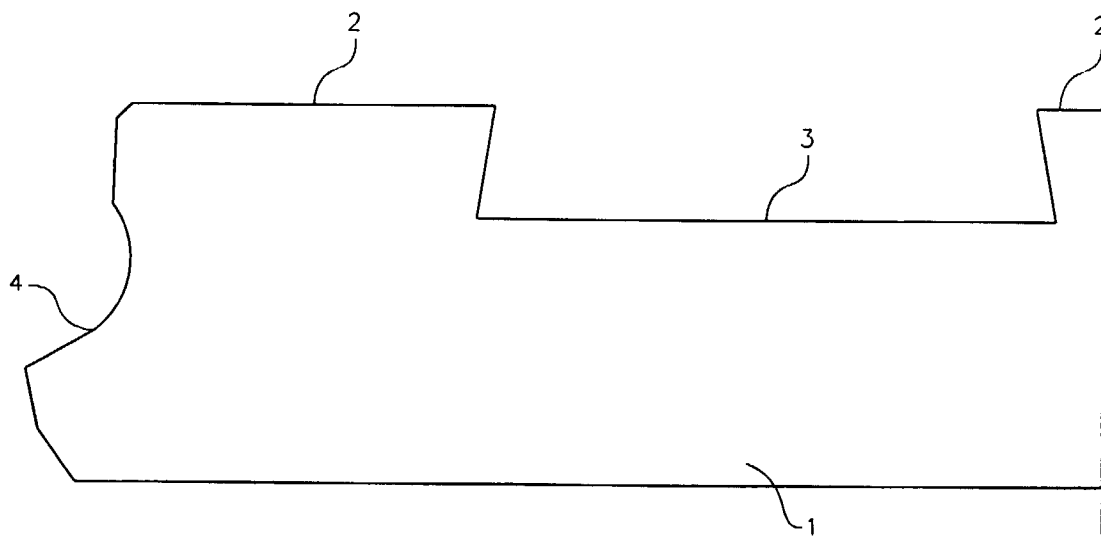


Fig. 2

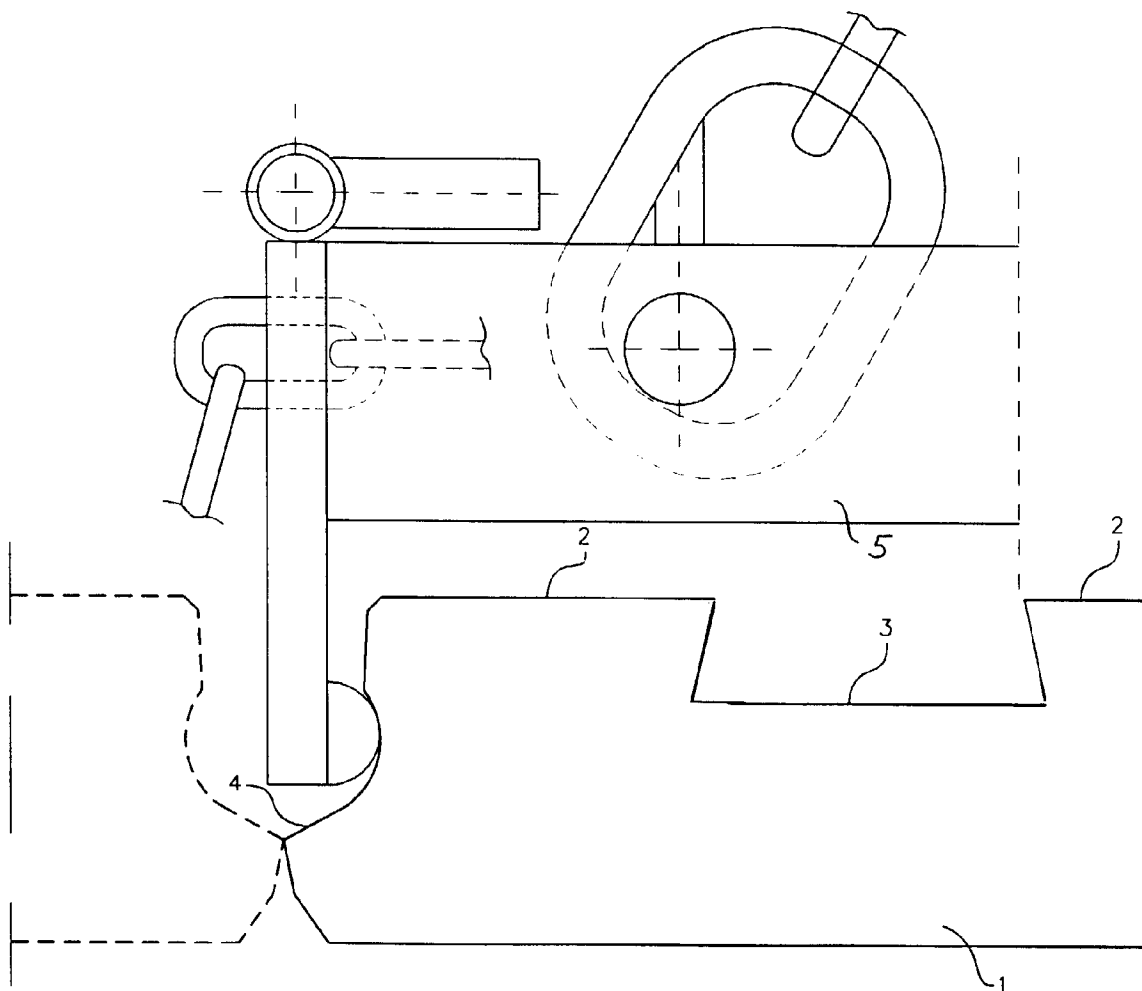


Fig. 3

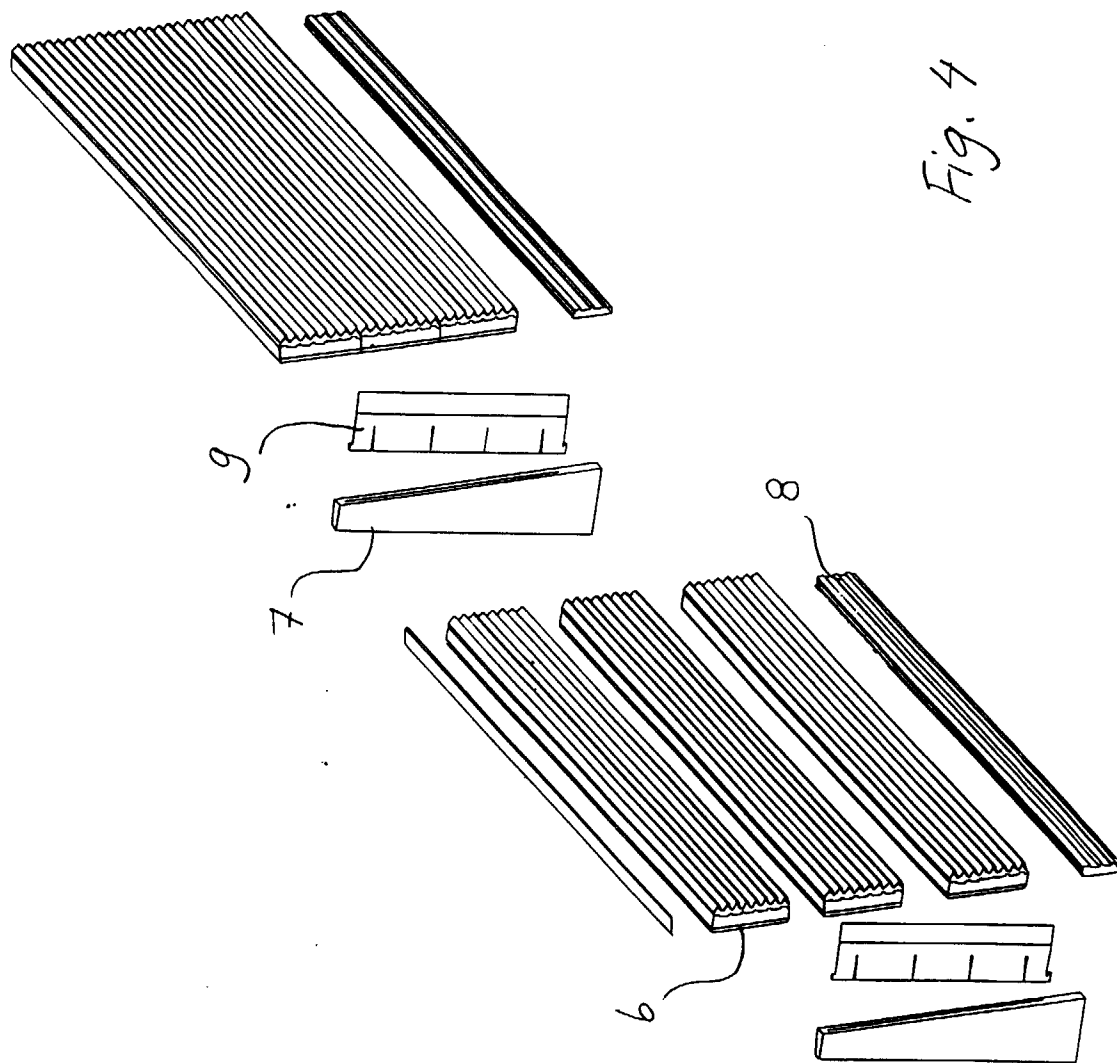
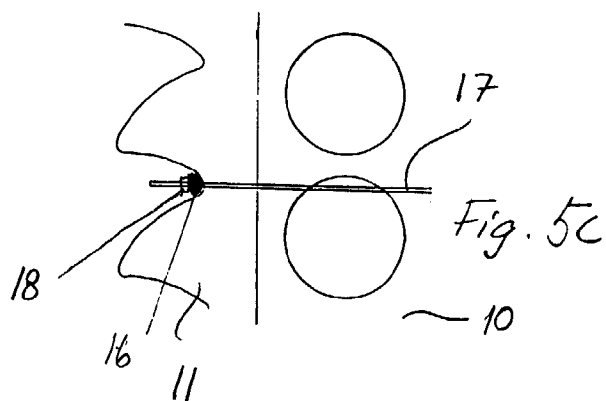
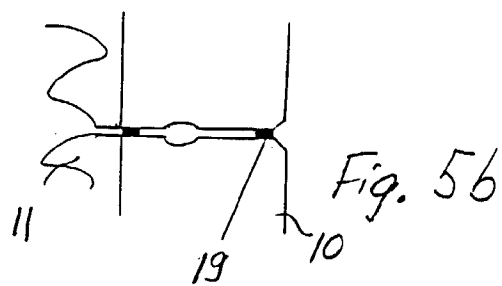
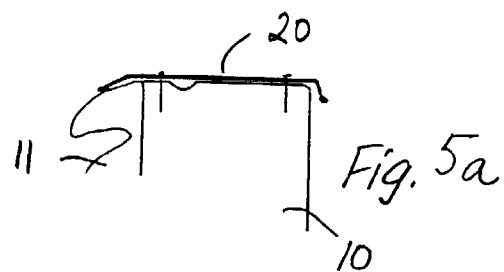
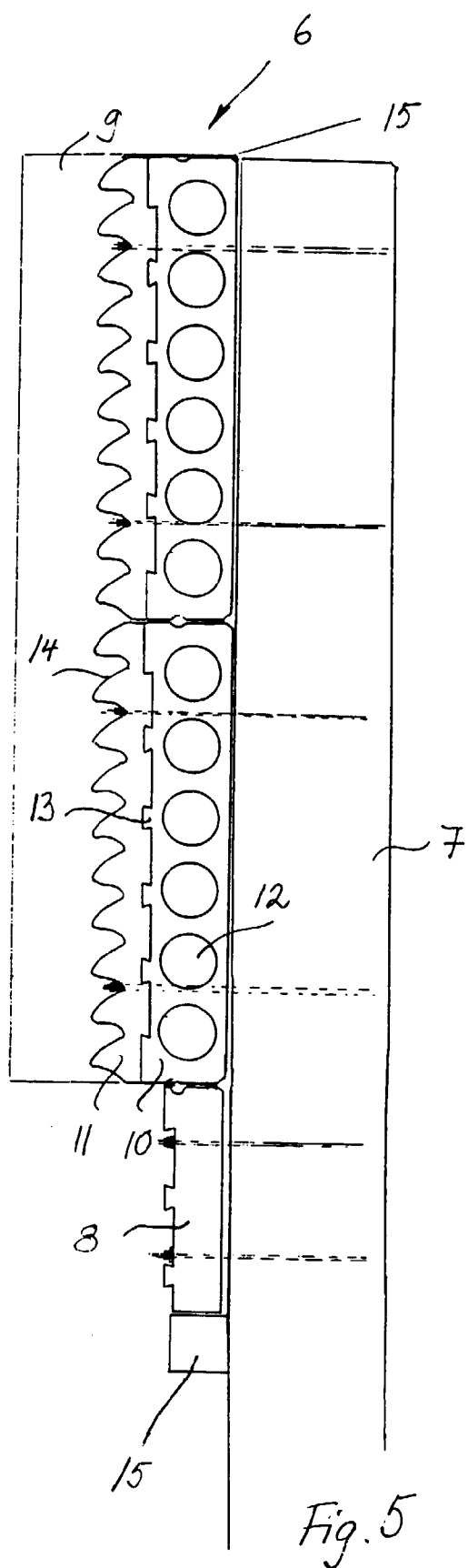


Fig. 4



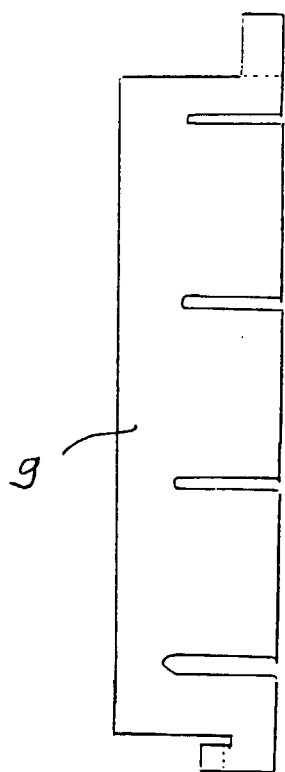
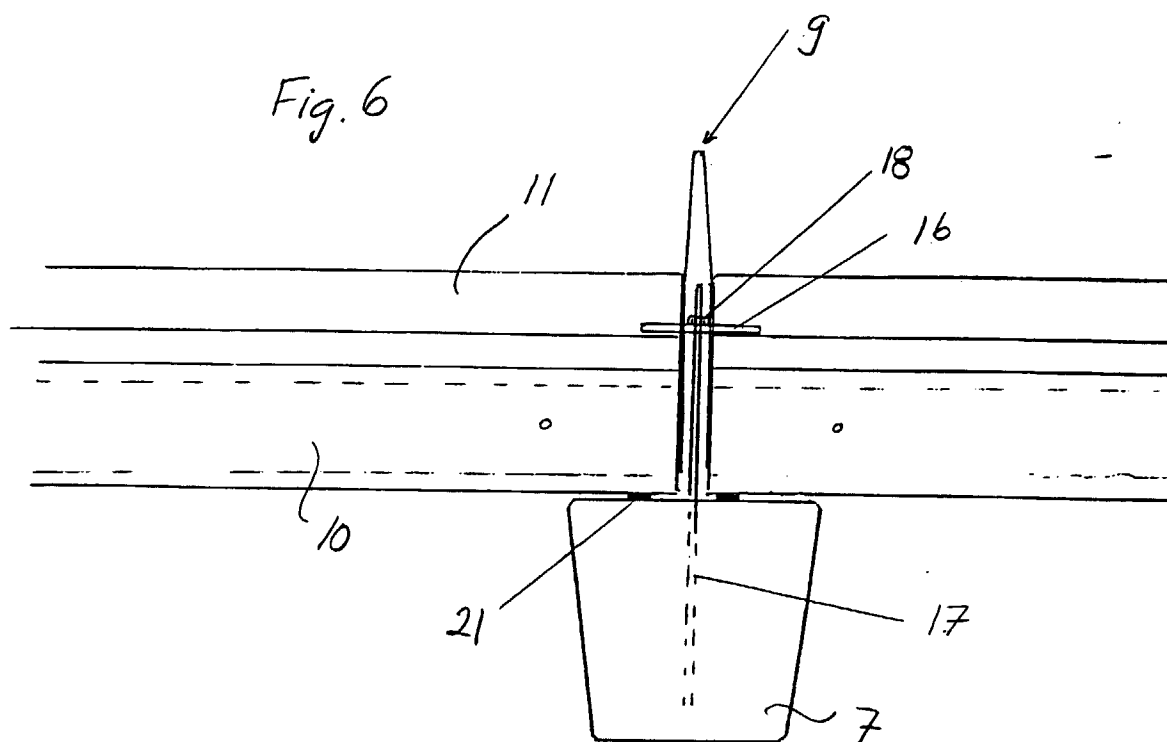


Fig. 7a

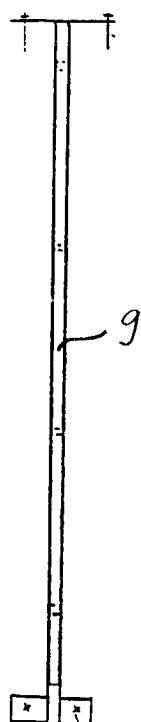


Fig. 7b



Fig. 7c