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54 **Sound screen.**

57 A sound screen for abating sound from a sound source, said screen comprising support members to which plate parts have been secured in a side-to-side configuration, which plates are of a light-transmissive material and comprise a stiffening that extends at least in a direction perpendicular to the longitudinal direction of the sound screen, which stiffening is made of a light-transmissive material so as to provide a maximally light-transmissive construction of the sound screen.

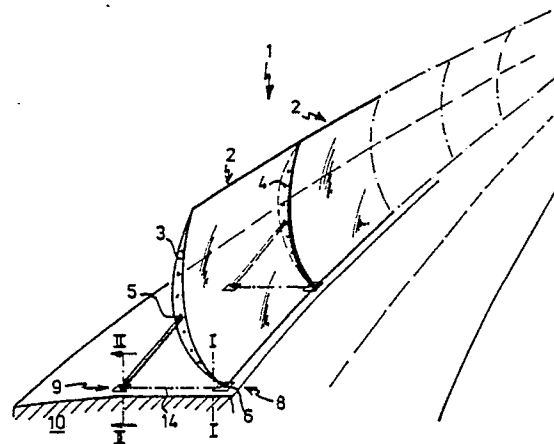


FIG.1

Sound screen

The invention relates to a sound screen, comprising a plurality of plate parts of an at least substantially light-transmissive material arranged in a side-to-side configuration, each plate part being secured to support members.

Such a sound screen is particularly employed when abating the sound caused eg. by motorcars or trains, in order to reduce the noise nuisance in residential areas that are eg. located along motorways or railroads, respectively. This known sound screen consists of regularly interspaced posts, anchored in a foundation, and flat, transparent plastic plates secured to said posts. The height of the sound screen can be varied, dependent on the adjacent buildings, and it is also determined by the demands made on the extent of noise reduction.

The known sound screen has the disadvantage that on account of the presence of the posts, particularly at an incident angle that is oblique with respect to the screen, the screen is opaque. This is contrary to the effect intended by the transparent plate parts, i.e. the invisibility of the sound screen. This invisibility is of great importance, as tests have shown, as with this type of sound barrier residents prefer a sound screen that hampers their view to the least possible extent, whereas on the other hand motorists also prefer a screen that is transparent to the largest possible extent in order to be able to visually relate to their surroundings as naturally as possible and thus to be able to get their bearings.

It is an object of the present invention to remove this drawback prevalent in known sound screens.

It is a further object of the invention to provide a maximally transparent sound screen that takes up as little surface area as possible.

For this purpose the invention provides a sound screen of the type referred to in the preamble, characterized in that each plate part comprises a stiffening of a substantially light-transmissive material, which stiffening extends at least in a direction perpendicular to the longitudinal direction of the sound screen.

On account of the stiffening of a substantially light-transmissive material formed on the plate parts themselves, a strong, light-transmissive construction is provided that is self-supporting, so that the posts can be omitted.

The stiffening is preferably formed by at least one rib that extends in a direction perpendicular to the longitudinal direction of the sound screen. In this arrangement each plate part may have a substantially arched curvature in a direction perpendicular to the longitudinal direction of the sound

screen, the rib being located at the round surface of the plate part. Apart from the constructive effect of the curvature of the plate parts, this curvature also contributes to removing the optical illusion that the road is narrowed as a result of the presence of the sound screen, which phenomenon is experienced as quite disturbing by motorists.

The invention will be elucidated hereinafter merely by means of an example, on the basis of a number of embodiments with reference to the drawing, in which:

fig. 1 is a perspective view of a part of a first embodiment of the sound screen according to the present invention;

fig. 2 shows a view of a section along the line I-I in fig. 1;

fig. 3 shows a view from the line II-II in fig. 1;

fig. 4 shows a perspective view of a second embodiment of the sound screen according to the invention;

figs. 5A, 5B and 5C show sections of a few embodiments of the sound screen according to the invention, the embodiment according to fig. 5B corresponding with that of fig. 4;

fig. 6 shows the securing to a viaduct of the sound screen according to fig. 4 and fig. 5B; and

fig. 7 shows a perspective view of a detail of the sound screen according to fig. 5C.

In the figures, corresponding parts have been given the same reference numerals.

Fig. 1 shows a part of a first embodiment of the sound screen according to the present invention, in which in this example the sound screen has been placed along one side of a road. The sound screen 1 comprises plate parts 2 that have been made of a light-transmissive material, such as (laminated) glass, a glass-fibre-reinforced polyester, transparent polyvinylchloride (PVC), acrylate, preferably polymethylmethacrylate (PMMA), polycarbonate and the like. Acrylate has a relatively high impact resistance and is also quite resistant against ultraviolet light and chemicals. The plate parts 2 may comprise a colour shade or they may have been treated at their surface in a manner that influences the transparency and/or in order to avoid possible undesired light reflections.

By means of support members 8 and 9 the plate parts 2 are supported by a foundation 10 that may consist of steel, concrete poured on the spot and/or prefabricated concrete.

The arched curvature shown in fig. 1 of the plate parts 2 in a direction perpendicular to the longitudinal direction of the sound screen may e.g. have been obtained by bending an initially flat plate part, e.g. by means of heating, in a mould. On

account of their curvature, the plate parts are extremely form-retaining. The thickness of the plate parts 2 and the extent of the curvature will also be determined by the demands made on the extent of the noise reduction. Occasionally a thickness of 5-12 mm and a screen height of 3 to 6 m is sufficient. With a thickness of 6 mm a sound resistance of as much as 30 dB is obtained. It may also be important to the form of the curvature whether a sound screen 1 is placed on either side of the road, in view of reverberation of the sound reflected by one sound screen to the opposite sound screen. If the curvature is suitably chosen, standing waves can be avoided and the sound is reflected upwards.

For illustrative purposes, fig. 5 shows a number of embodiments of the sound screen according to the invention, each having a different screen height. The extent of the curvature from the base of the screen, however, is always the same, so that even with screens of which the height varies in the longitudinal direction, a continuous connection of the plate parts is obtained. With the above-mentioned materials, the sound screen 1 will substantially obtain its sound-abating quality due to a reflection of sound on the plate parts 2.

The plate parts 2 comprise a stiffening in the form of ribs 3 that are glued to the round surface of the plate parts 2 by means of a transparent glue or fixed by means of dowel joints (not shown), preferably with dowels of a light-transmissive plastic. The ribs 3 may e.g. have cross-sectional dimensions in the range of 50-100 mm in the one direction, and extend to approximately 300 mm at the most in the other direction. Along the length of each rib 3, securing means 5 and 6 are present for securing the rib to the pertaining support members. The material of the ribs 3 is at least substantially light-transmissive and preferably the same as that of the plate parts 2.

Apart from the ribs 3, the stiffening may also have the form of edges, e.g. bent thermoplastically, at the upper and/or lower edge of each plate part 2. Fig. 4 shows a bent edge 21 illustrated at the top edge of the plate parts 2 in a second embodiment of the sound screen according to the present invention.

Fig. 2 shows a section along the line I-I in fig. 1. In the represented embodiment the ribs 3 are each mounted on the head edge of a plate part, so that the securing means 5 and 6 of adjacent ribs of adjacent plate parts 2 may be joint, so as to provide a joint securing of the pair adjacent ribs to the pertaining support members. The adjacent ribs may be interconnected by means of dowels 4 of a light-transmissive synthetic material, vide fig. 1. In this arrangement, preferably a possible thermal expansion of the plate parts is taken into account and

also tolerances of the plate parts and other parts of the sound screen, as well as adjustment tolerances by means of e.g. fixedly glueing a dowel to the one rib and by allowing some clearance in the other ribs with respect to the hole into which the dowel is inserted.

The securing means 6 and also the securing means 5 are preferably formed by a hole that is provided in the rib 3, through which a sleeve 7 is inserted, having an outer diameter of e.g. 30 mm, said sleeve 7 comprising threadings at its ends, which threadings cooperate with threaded metal bolts 11. Rings have been received between the bolts 11 and the ribs 3. By choosing a light-transmissive material for the sleeve 7, the pin connection can be devised as light-transmissive to the largest possible extent.

As is shown in fig. 2, the support member 8 is formed by a base 12 comprising an upright steel plate 13 with a hole for allowing the sleeve 7 to pass. In this manner a hinge bearing with the pin connection is obtained.

Fig. 3 shows a view from the line II-II in fig. 1. The support member 9 is formed by a base 15 with an extension piece in the form of a rod 16 with a diameter of e.g. 100 mm, a steel plate 17 being secured to the base 15. Said plate 17 comprises a hole for allowing a sleeve 19 to pass, in order to provide a pin connection that is similar to the pin connection of the support member 8. The rod 16 is preferably made of a light-transmissive material, e.g. acrylate, and is connected to the base 15 by a swivel connection via a bow 20 comprising two parallel plates with coaxial holes on the one hand, and to a plate cooperating with the securing means 5 on the other hand, so that it is possible to adjust the length of the support member 9 when positioning the sound screen 1. The plate cooperating with the securing means may be formed in accordance with the plate 13 of the base 12 or the bow 20 at the other end of the rod 16.

By stiffening the plate parts 2 by means of the ribs 3 mounted thereon it is sufficient to provide support merely by support members 8 and 9, which moreover are disposed on surfaces of the plate parts that face away from the sound source, so that the visual disturbance referred to above is not or hardly the case here. If desired, a tensioning construction 14 can be provided as indicated in dotted lines in figure 1, so as to further reinforce the support members 8 and 9.

Fig. 4 shows an illustration of a support member 22 which comprises a horizontal, steel perimeter beam 23 on which on either side of a pair of ribs 3, shoes 24 have been mounted that keep the plate parts 2 in their position by means of pins 25, e.g. bolts that are inserted in the holes provided in the ribs.

The perimeter beam 23 is mounted on foundation piles 27 that are stuck into the ground and that are horizontally anchored by means of obliquely bored anchors 28. A soil retainer 29 of prefabricated reinforced concrete is arranged between the piles 27.

In order to establish with the pins 25 an even force transmission on the ribs 3, which, unlike steel, are relatively vulnerable, each rib is preferably provided opposite each shoe with one or more steel plates 26 with corresponding pin holes, which plates are each glued to the rib. Fig. 4 shows only one plate 26. On account of the thermal expansion and creep, each time an interspace may be provided between a plate 26 and the pertaining shoe 24 and/or between facing plates 26, which interspace is bridged by the pins 25. In this way, so as to have maximum transparency for the sound screen, the support member 22 can be of relatively limited dimensions. In a similar way, the support members 8 and 9 in the embodiment according to fig. 1 may also be provided with plates 26.

Fig. 5B shows a section of the screen according to fig. 4.

The shoes 24, the plates 26, the perimeter beam 23 and the piles 27 are preferably made of thermally galvanized steel. The perimeter beam 23 may e.g. comprise elements of set plate steel with a thickness of 8 mm and a length of 4 m. The perimeter beam 23 may have adjustment means both in horizontal and vertical direction for precise positioning.

Moreover, the support members 22 only take up little surface area, which is important in practice, e.g. if the sound screen is mounted on viaducts in large towns.

Fig. 6 shows a further illustration of the mounting of the sound screen on a viaduct. The piles 27 are anchored to the road surface.

Plate parts 2 of relatively great heights may comprise support members 22 that moreover comprise an extension piece 30 in the form of a steel fork, as is represented in fig. 5C and, in more detail, in fig. 7. The extension piece 30 may be integrated with the pertaining shoes 24. By means of the fork 30, the moment load at the base of the plate parts 2 is reduced, without requiring a greater surface area for the sound screen.

Between each pair of adjacent ribs 3 preferably a light-transmissive, flexible sealing means is accommodated for sealing the slits between the adjacent ribs 3. In the given example the sealing means is formed by a transparent hose 18 of plastic, said hose 18 extending over the length of the pair of ribs.

The sealing means, e.g. of extruded, transparent acrylate, may also be a strip that has been inserted in two oppositely disposed grooves in the ribs.

It may be clear that experts may amend the above-described embodiments of the invention without going beyond the scope of the present invention.

Claims

1. Sound screen for abating sound from a sound source, said screen comprising a plurality of plate parts of an at least substantially light-transmissive material arranged in a side-to-side configuration, each plate part being secured to support members, **characterized in that** each plate part comprises a stiffening that extends at least in a direction perpendicular to the longitudinal direction of the sound screen, which stiffening is made of a substantially light-transmissive material.

2. Sound screen according to claim 1, **characterized in that** the stiffening is formed by at least one rib extending in a direction perpendicular to the longitudinal direction of the sound screen.

3. Sound screen according to claim 2, **characterized in that** each plate part shows a substantially arched curvature in a direction perpendicular to the longitudinal direction of the sound screen, the rib being located at the round surface of the plate part.

4. Sound screen according to claim 2 or 3, **characterized in that** the rib extends longitudinally up to the edges of the plate part, the rib being provided at at least one of its ends, as well as at at least one location remote from the two ends of the rib, with a securing means for fixing the rib to the pertaining support members.

5. Sound screen according to claim 4, **characterized in that** each securing means is formed by a hole through a rib, which hole extends in the longitudinal direction of the plate part, and a pin inserted into the hole.

6. Sound screen according to claim 5, **characterized in that** the pertaining support members are formed by a first base that cooperates with the hole located at the one end of the rib so as to provide a hinge bearing, and a second base that cooperates through the intermediation of an extension piece with the hole that is remote from the two ends of the rib so as to provide a hinge connection.

7. Sound screen according to claim 6, **characterized in that** the first base comprises at least one first plate that is provided with a hole that is coaxial to the pertaining hole of the rib, the pertaining pin having been inserted into the respective holes.

8. Sound screen according to claim 6 or 7, **characterized in that** the extension piece is a rod of an at least substantially light-transmissive material, wherein at least one second plate is secured

to the end of the rod facing towards the rib, said plate comprising a hole that is coaxial to the pertaining hole in the rib, and wherein the pertaining pin has been inserted into the respective holes.

9. Sound screen according to claim 8, **characterized in that** the rod is connected to the second plate and to the second base by means of a swivel connection.

10. Sound screen according to one of claims 5 through 9, **characterized in that** the pin is formed by a sleeve of a light-transmissive material, said sleeve comprising threading at its ends so as to cooperate with threaded bolts.

11. Sound screen according to one of claims 2 through 10, **characterized in that** said ribs are mounted onto each plate part at their head edges, the securing means of adjacent ribs of adjacent plate parts each being joint, so as to provide a joint securing for the pair of adjacent ribs to the pertaining support members.

12. Sound screen according to claim 11, **characterized in that** between each pair of adjacent ribs a sealing means of a flexible, at least substantially light-transmissive material has been accommodated, the sealing means extending over the length of the pair of ribs.

13. Sound screen according to one of claims 2 through 12, **characterized in that** the ribs are glued to the plate parts.

14. Sound screen according to one of claims 2 through 12, **characterized in that** the ribs are secured to the plate parts by dowels of a light-transmissive synthetic material.

15. Sound screen according to claim 2 or 3, **characterized in that** the support members are formed by a plurality of shoes that are each secured by a securing means to one end of a rib.

16. Sound screen according to claim 15, **characterized in that** the shoes are mounted on a beam extending in the longitudinal direction of the sound screen.

17. Sound screen according to claim 15 or 16, **characterized in that** a number of shoes comprises an extension piece that is situated on the side of the sound screen facing away from the sound source and that extends from the shoe up to a location that is remote from the two ends of the pertaining rib, in which location the extension piece is secured to the rib by means of further securing means.

18. Sound screen according to one of claims 6 through 17, **characterized in that** on each rib at the location of one or more support means one or more plates have been glued that each comprise one or more holes for cooperation with the securing means.

19. Plate part as described as part of the sound screen according to one of claims 1 through

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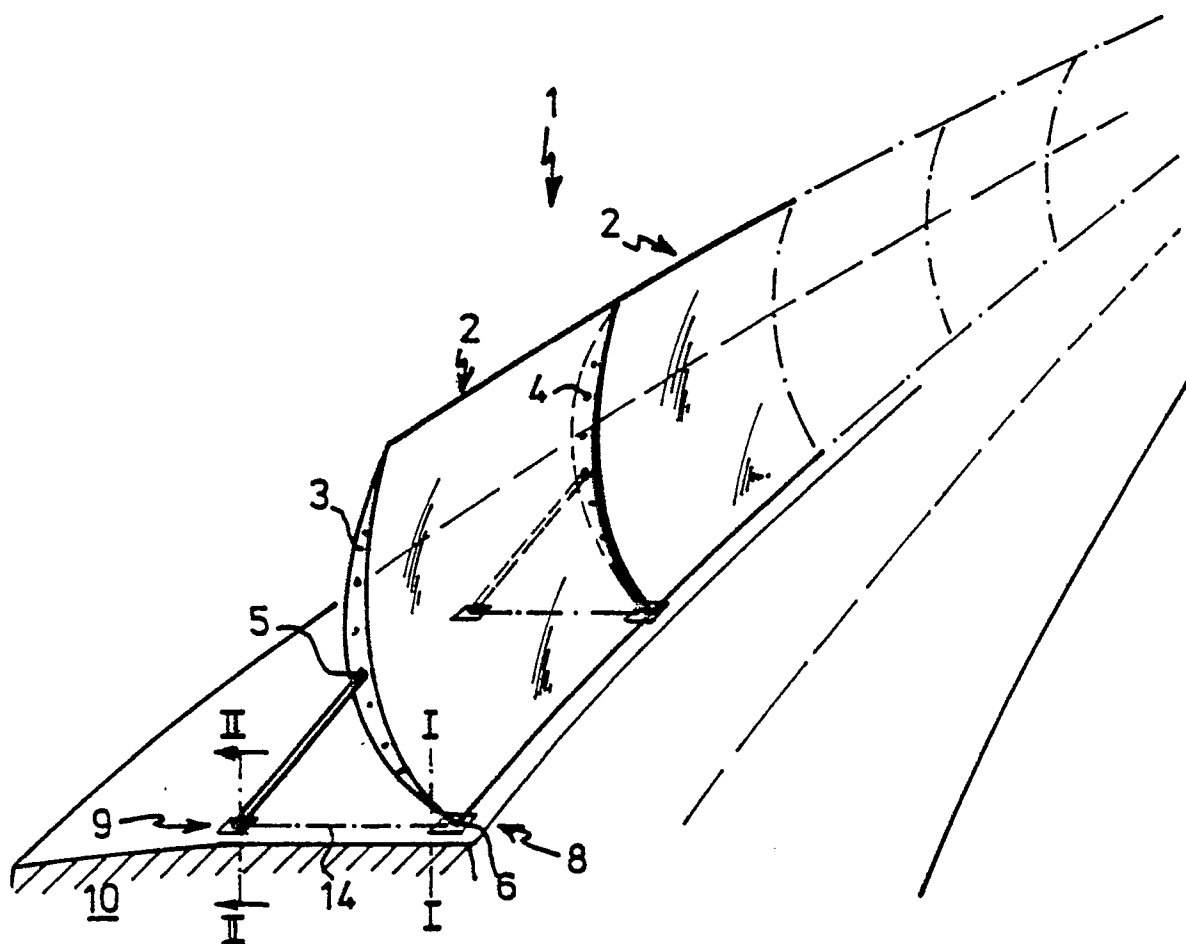


FIG.1

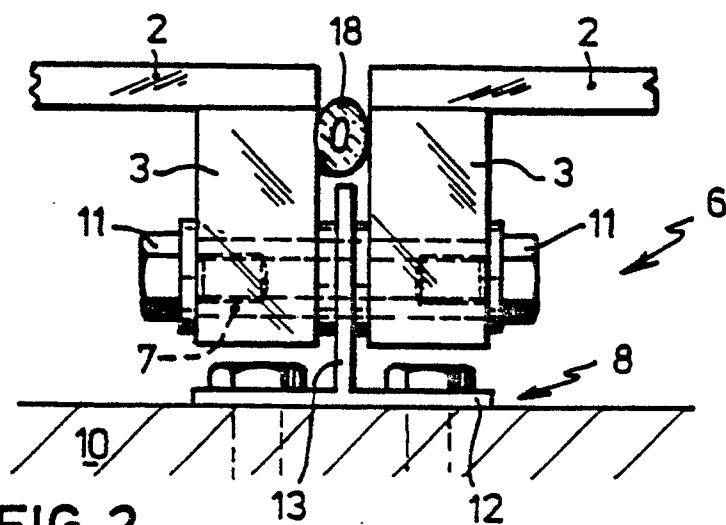


FIG. 2

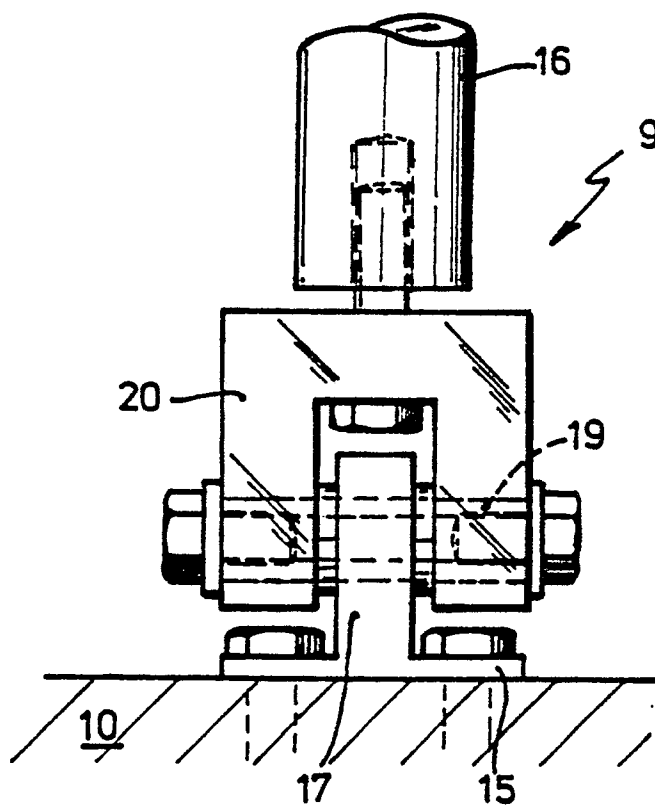


FIG. 3

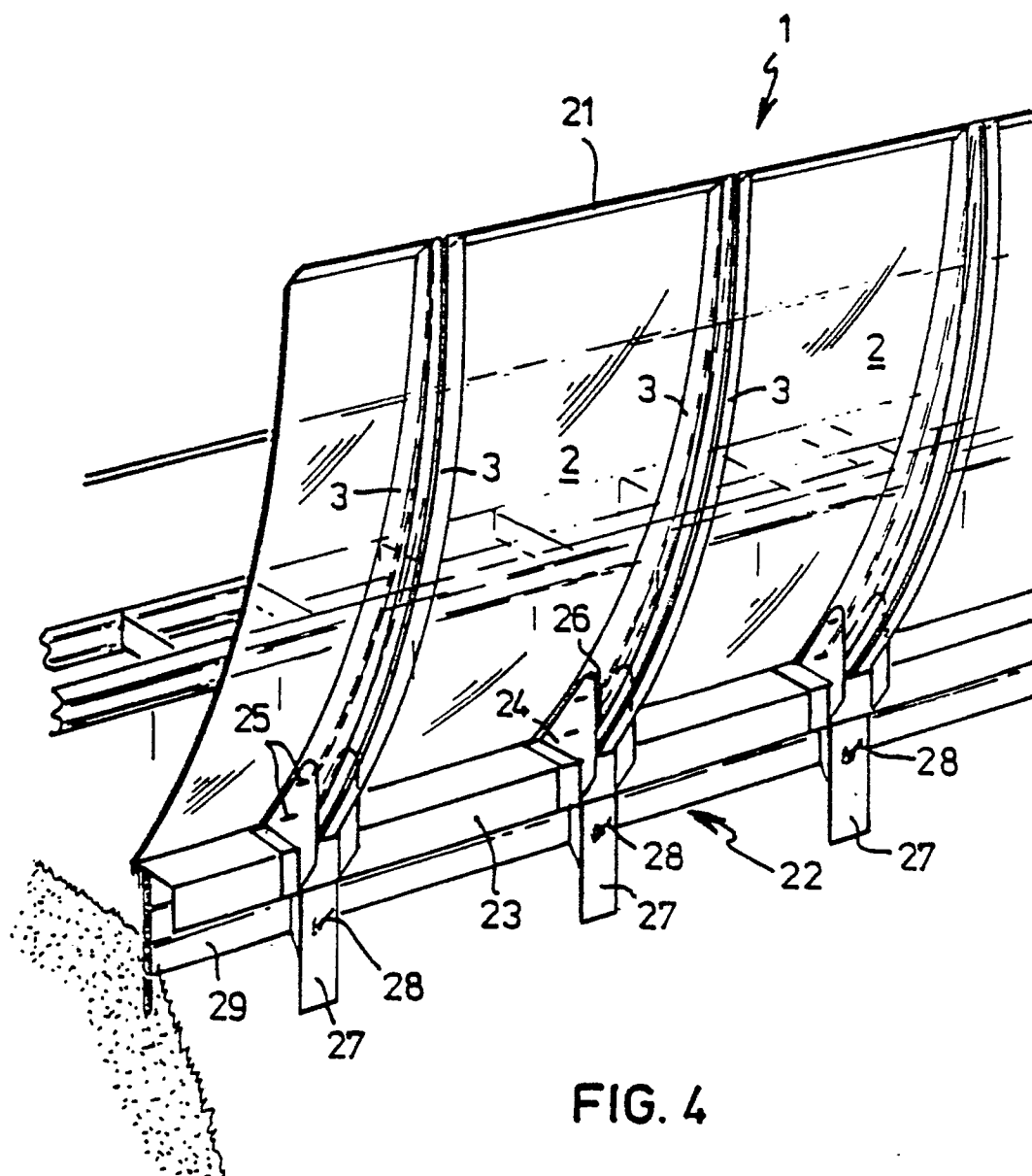


FIG. 4

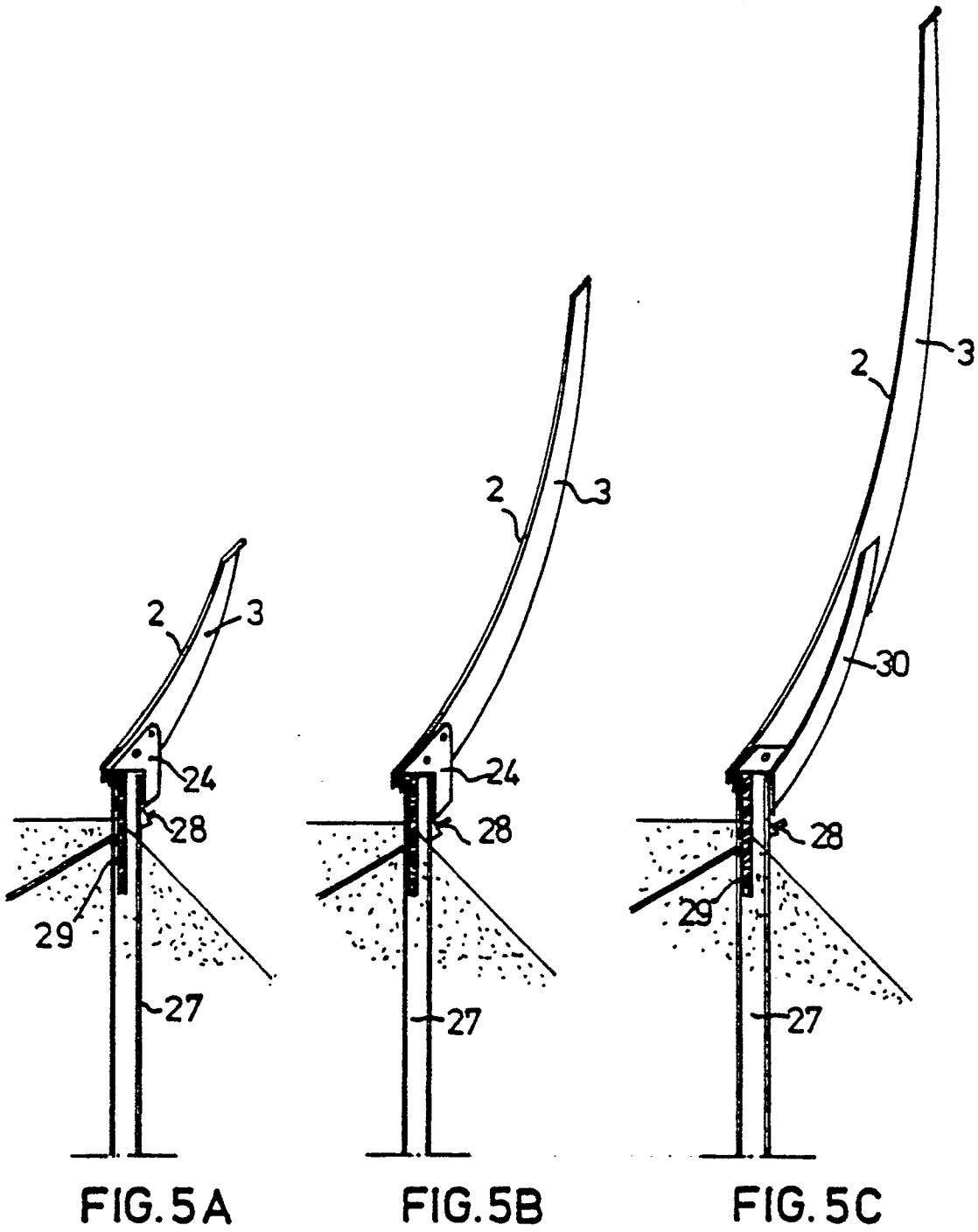


FIG. 6

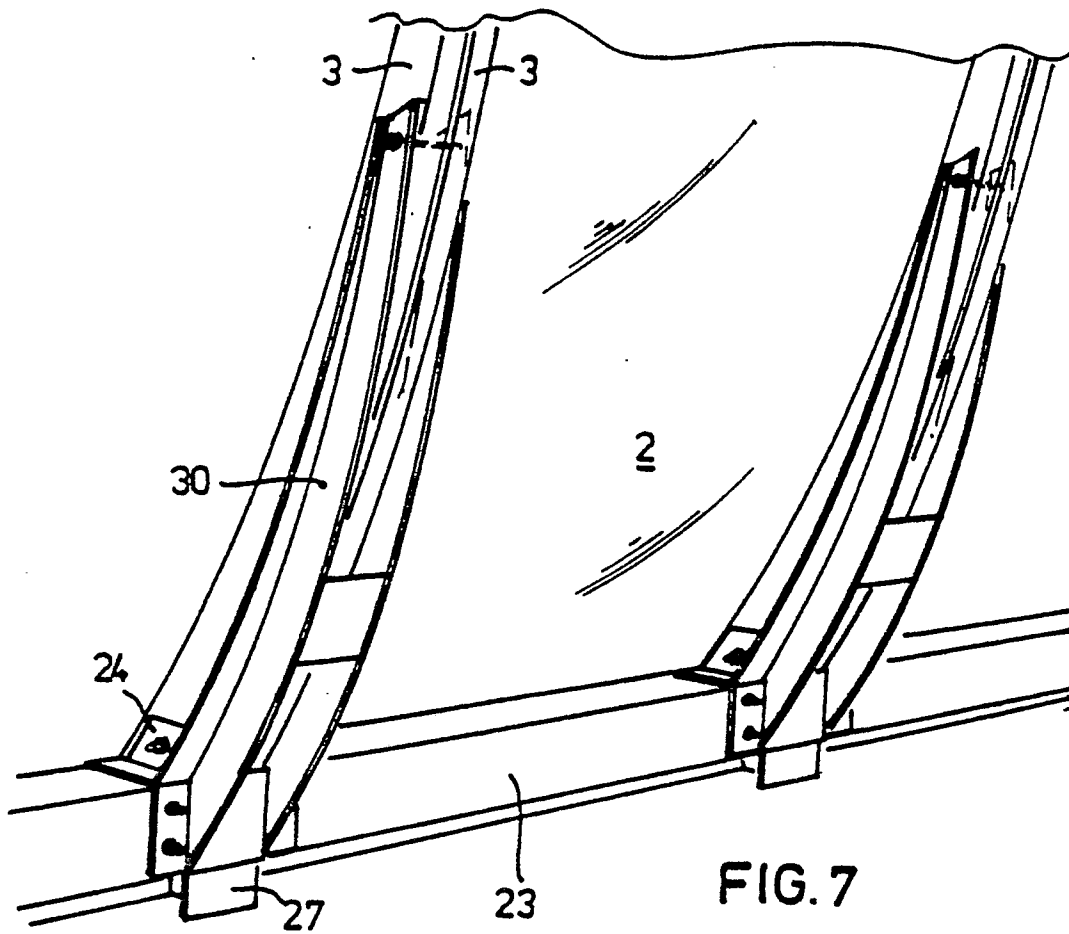
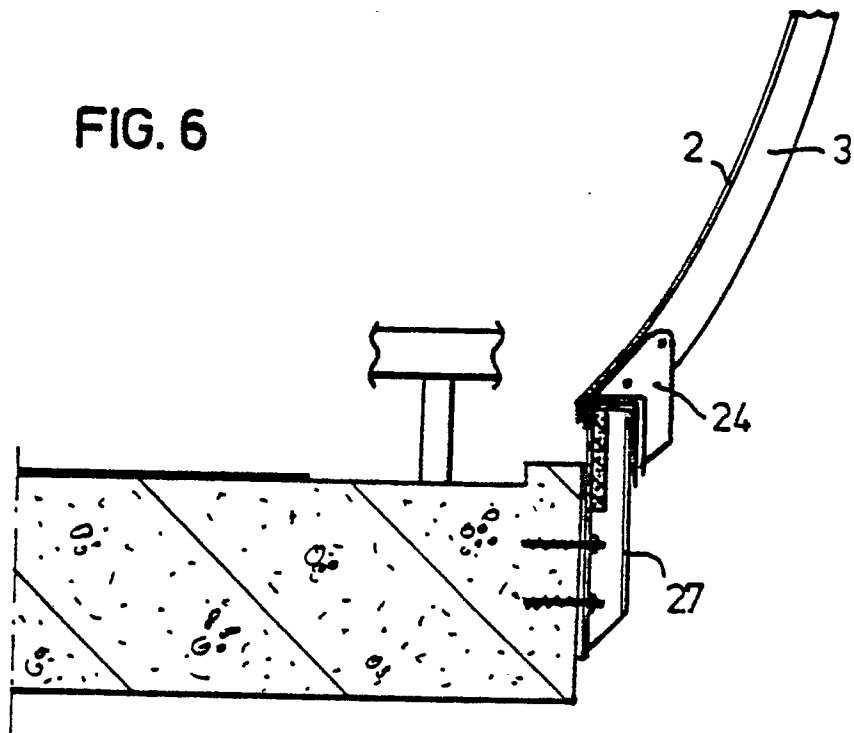


FIG. 7



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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 214 411 (PICKETT)(29-07-1980) * Column 1, lines 7-9; column 2, lines 59-61,67,68; column 3, lines 1,5-8; column 4, lines 38-44; figures 1,5,6 *	1-3,19	E 01 F 8/00 E 01 D 19/10 E 04 C 2/54
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X	FR-A-2 456 362 (CLERC)(05-12-1980) * Page 1, lines 1-3,22-30,32-36; page 2, lines 7,8,11-19,32,33,35-37; page 3, lines 1-4,6-14; figures 2,3 *	1,2,19	
A	---	3,6,8,9,11	
A	GB-A- 901 935 (ECKARDT)(25-07-1962) * Page 1, lines 54-56,64-68; page 2, lines 3-5,12-14,16-18,59-67,82-92,121-124; page 5, lines 12-16; figures 1,3,5,17 *	1-3	
P,X	NL-A-8 702 073 (DECOSTONE)(03-04-1989) * Page 2, lines 3-8,11-14,19-28; page 4, lines 4-8; figures 1,3 *	1-3,19	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	---	4,16	E 01 F E 01 D E 04 C
A	GB-A- 826 688 (ELLIS et al.)(20-01-1960) * Page 1, lines 13-15,42,43; page 2, lines 1-4,16-18,26,27; figures 3,4 *	1-3	
A	US-A-3 290 850 (BYRNE et al.)(13-12-1966) * Column 1, lines 9-19,46-52,56,57; figur 1 *	1,2	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18-05-1990	Examiner SCHUMAN R.
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons * : member of the same patent family, corresponding document	



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A	DE-A-2 213 777 (MAIBACH)(27-09-1973) * Page 1, lines 1-5; page 3, lines 8-11,18-21,25; page 4, lines 1-5,9,10,23 - page 5, line 1; page 7, lines 7-11,16-20; page 8, lines 1-6,12-19; page 9, lines 3-5,10-13,16-20; figures 2-4,6 * ---	1,2,4,5 ,12,19	
A	CH-A- 555 448 (ALFREDO PIATTI AG) * Column 1, lines 1-3,12-14,40-42,44-48,56-57,61,62,64; column 2, lines 21-23; figures 1,3 * ---	1,2,4, 11,12, 19	
A	CIVIL ENGINEERING-ASCE, vol. 43, no. 11, November 1973, pages 56-59; J.D. COLLINS: "California tackles highway noise" * Page 59, box "Will noise barriers help?", figure 2, configuration 3 * ---	3,4,6	
A	FR-A-2 478 698 (S.A. PROCI)(25-09-1981) * Page 1, lines 13-15,21,22; page 2, lines 10-14,26 - page 3, line 4; page 4, lines 15-17; page 6, lines 9,10; figures 1,3 * ---	3,12	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
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A	--- BmK - BAUEN MIT KUNSTSTOFFEN, no. 2, June 1987, page 31, Heidelberg, DE; "Transparente Lärmschutzwand" * Figures 1-3 *	3	
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A	--- WEG EN WATERBOUW, vol. 7, no. 4, April 1982, pages 18-19; "Geluidwerende schermen Gaasperdammerweg" * Page 18, lines 19,20,22-30; figure 3 *	3	
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A	US-A-4 069 768 (MATSUMOTO et al.) * Column 1, line 64 - column 2, line 11; column 14, lines 17-23,26-29,37-45; column 15, lines 1-13; figures 40,41,44 * -----	15	
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