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(54) **Noise-suppression barrier**

(57) A noise-suppression construction extending along a predetermined laying direction comprises a predetermined number of active elements (2) to be associated along at least one predetermined mutual-approaching direction; the active elements (2) are made

of a material comprising a plurality of resistant fibres buried in a matrix; the barrier (1) further comprises interlocking means (6) designed to interlock the active elements (2) with each other along operating directions substantially transverse to the mutual-approaching direction and/or the laying direction.

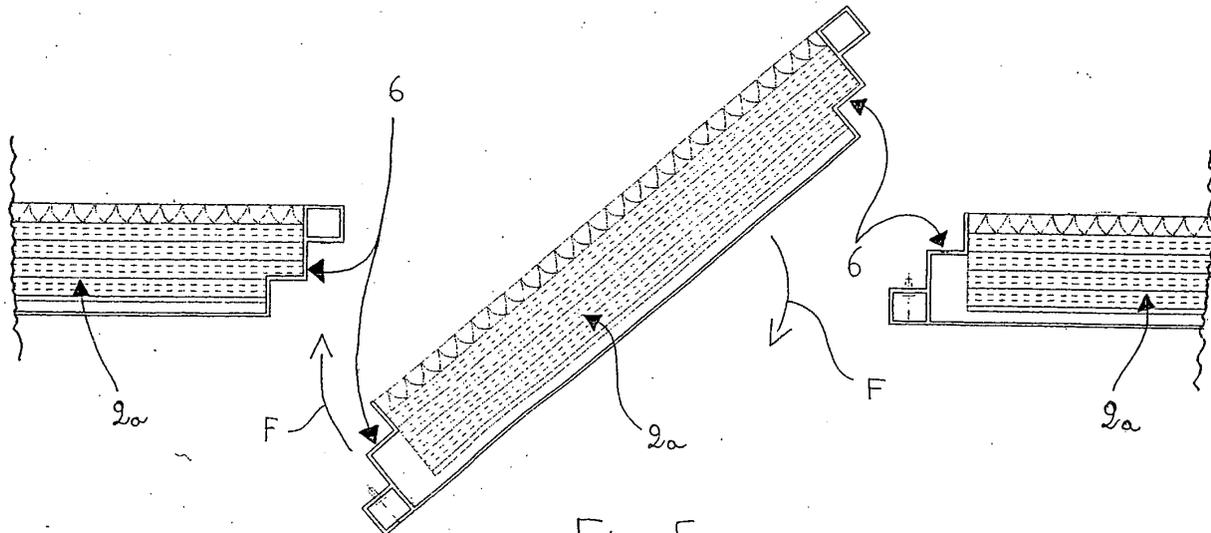


Fig. 5

Description

[0001] The present invention relates to a noise-suppression construction to be particularly used in road structures and communications networks.

[0002] It is known that due to the great increase in the vehicle traffic and the important density of town centres, situations are created in which many inconveniences arising from the so-called "sound pollution" are present; in fact, as a result of the great vicinity existing between highways (or at all events communications lines subjected to a very intense stream of cars and heavy transport means) and habitable areas (dwelling houses, offices, parks, gardens and others), the noise produced by the traffic in an intensive and continual manner constitutes and important source of trouble, and sometimes even a cause of malaise or at all events of decline of the environment quality.

[0003] Looking at the matter under this point of view, in the recent years a need has been felt to limit damages resulting from noise transmission from the road works to the built-up areas; to achieve this aim, different typologies of devices, exactly called "noise-suppression barriers" have been envisaged, the main task of which is to absorb sounds generated by vehicles in transit, and/or prevent them from propagating to the built-up areas.

[0004] In accordance with the presently most widespread technology, these noise-suppression barriers of known type consist of a series of acoustic insulation elements that in turn are mutually held in place by a series of posts emerging from the ground. The noise-suppression barriers of known type are usually made of wood or metal (in the last-mentioned case, the metal parts are possibly integrated with layers of sound absorbent material) and have a construction architecture substantially involving superposition of a plurality of acoustic insulation elements that are vertically piled up, upon each other, while at the end sides thereof they are linked to the posts.

[0005] While the known art briefly described above is greatly simple from a construction point of view and is widely applied, it however has some limits and drawbacks under different points of view.

[0006] In fact, it is first to be noted that the particular relative arrangement of the acoustic insulation elements is of little effectiveness from a structural point of view, because the acoustic insulation element positioned at the innermost point of the stack is strongly compressed by the weight of the overlying elements. This often gives rise to deformations or even bellying of the innermost elements (with adverse consequences not only as regards the aesthetic aspect, but also in terms of acoustic and structural effectiveness of the barrier itself).

[0007] In addition, this particular stacking typology does not appear to be practical in connection with assembling and/or disassembling of the barrier. Since the acoustic insulation elements need to be piled up by sequentially introducing them between two posts (that

have been already set in the ground), use of expensive and bulky machinery is required and above all the necessary setting operations must follow a very rigid and not very adaptable sequence. At the same time, if one or part of the acoustic insulation elements is required to be replaced (due to damaging caused by said weight effects or by the impact of a vehicle against the barrier, for example), dismantling of the whole noise-suppression barrier is made necessary in order to enable the concerned panel (or panels) to be reached.

[0008] It is also to be pointed out that the noise-suppression barriers of known type are intrinsically made up of rather heavy elements; this involves the fact that both the support posts (that therefore must be sufficiently rigid and stout or in any case are to be present in a great number) and the acoustic insulation elements (that discharge their weight on one another) must endure a great fatigue; at the same time the heavy weight of the concerned components makes the barrier handling and mounting operations unfavourable. (Said barrier is unlikely to be pre-assembled and brought to the setting place). For the same reason, metal barriers hardly lend themselves to be installed in particular areas (such as bridges or overhead or elevated roads), because they involve a great increase in the load to be carried by the road structure itself.

[0009] A further drawback to be highlighted is that in barriers made of metal, many problems connected with corrosion arise. In more detail, the acoustic insulation elements made of metal must be conveniently protected against the aggressive action of the atmospheric agents and/or against phenomena of electrolytic corrosion. For this reason, wide and expensive painting operations (or more generally appropriate surface treatments) are made necessary, which operations at all events have a limited protection degree, due to the fact that possible accidental impacts with stones or other objects on the barrier can locally remove the protection and in any case trigger starting of corrosion. Alternatively, stainless metal alloys are to be selected and this once more involves a great increase in costs.

[0010] Not to be forgotten is also the fact that often the surface protections of this metal components can even be spoiled during the production steps, due to bending, punching, perforating, welding and other operations for example.

[0011] Still referring to corrosion problems, it is to be noted that also the inner part of the acoustic insulation elements (that, as already said, houses a given amount of sound absorbent material, that generally consists of rock wool) is subjected to problems of corrosion, mainly of the electrolytic type.

[0012] In an attempt to counteract these corrosion phenomena, the inner contact areas between the metal element and the sound absorbent material are to be reduced as much as possible, and this makes manufacture of the individual construction pieces much more complicated.

[0013] At all events, problems of inner corrosion also occur due to rainwater deposits seeping through the elements; these water deposits are likely to take place in particular at the lower elements of the stack but due to the stacking nature itself, the rainwater percolating through the elements passes from one element to the other and finds a great number of stagnation surfaces at which it can accumulate and even exude within the elements themselves.

[0014] Still in connection with phenomena linked to the electroconductive nature of metal barriers, it is also to be pointed out that noise-suppression barriers made of these materials must necessarily be grounded, to avoid accumulation of electric charges (on occurrence of storms or others, for example); in addition metal barriers act as shields for radio waves, representing a hindrance to transmissions.

[0015] In addition, noise-suppression barriers made of metal are subjected to great variations in sizes depending on temperature; this makes planning and construction of the barrier itself more complicated and ultimately adversely affects stability and effectiveness of same.

[0016] Then, an important limitation of metal barriers of known type resides in that the acoustic insulation elements that are box-shaped bodies are associated with the posts at end regions thereof that generally cannot be conveniently filled with rock wool (or even only consist of metal). In this junction regions the properties of attenuating and/or reflecting the sound waves are unsatisfactory and this practically causes a reduced effectiveness of the noise-suppression construction.

[0017] An insufficiency of acoustic insulation in the barriers of known type is also due to the fact that, taking into account the particular geometries of the junction regions, gaps or in any case empty spaces are defined within which the sound waves can pass rather easily; to obviate these inconveniences, often introduction of appropriate acoustic-seal elements is made necessary, which obviously brings about an increase in the construction complexity and costs.

[0018] Noise-suppression barriers made of wood have different drawbacks as well, that partly can be of the same type as those of metal barriers, but that can be also specifically connected with the nature of the material itself.

[0019] In fact, while they are not subjected to oxidation processes, the components of wood barriers can be adversely affected by humidity (so that they can swell or go out of shape in an anisotropic way), and also can be attacked by parasites, moulds and/or mushrooms. For the above reason, it is once more necessary to resort to surface protections that in any case are not 100% reliable and cause an increase in costs.

[0020] Wood constructions are also inflammable and at all events have a reduced duration over time; furthermore, the price of the raw material is in some cases disadvantageous from an economical point of view.

[0021] Finally, it is also to be remembered that noise-suppression barriers of known type have an outer appearance of poor aesthetic value, and above all they cannot be integrated (and sometimes not even dissimulated) into the surrounding environment; possible additions of an aesthetic character can be made to these constructions of known type, but times and costs are considerable and above all they have a reduced duration.

[0022] Under this situation the technical task underlying the present invention is to conceive a noise-suppression construction capable of substantially obviating the mentioned limits.

[0023] Mainly, it is an object of the present invention to conceive a noise-suppression construction having an innovative and original building architecture enabling easy assembling (and possibly a disassembling as easy as assembling); in addition, in accomplishing this technical task, the present invention is also dedicated to conceiving a noise-suppression construction where it is possible to intervene on the individual constituent elements (i.e. without the whole construction necessarily needing to be dismantled).

[0024] Concurrently with the above, it is an aim of the present invention to create a noise-suppression construction having a high structural efficiency (i.e. great stiffness, together with great effectiveness in absorbing and reflecting noise) and at the same time being of a weight as much as possible reduced.

[0025] At the same time, it is also to be noted that the present invention aims at making a noise-suppression construction capable of having different configurations depending on the typology of the noise source to be insulated and/or on logistic requirements: for example, it is an aim of the present invention to make a noise-suppression construction adapted to have a structure defining an acoustic insulation booth to be used to absorb and/or eliminate the noise produced by fixed noise sources for example, such as power units, compressors, motors and so on.

[0026] On the other hand, also within the aims of the present invention is the technical possibility of mounting the noise-suppression construction following a flexible procedure that can be expressly adapted to circumstances; together with the above aim, it is also to be noted that the present invention enables manufacture of a noise-suppression construction adapted to be set or laid according to complicated arrangements on the ground (and not limited to being extended in a single linear laying direction, which on the contrary disadvantageously occurs in barriers of known type).

[0027] Within the scope of the above technical task it is also an important aim of the invention to envisage a noise-suppression construction that is substantially free from problems of corrosion and thermal expansions and also unaffected by attacks from corrosive agents and/or animal or vegetable parasites.

[0028] Furthermore, the present invention aims at

making a noise-suppression construction having optimal acoustic-insulation characteristics, also at the junctions between its different components; at the same time, the present invention aims at making a noise-suppression construction that has no problems of electric conductivity (so that grounding is not required and also it does not constitute a barrier for radio waves and telecommunications signals as well).

[0029] The present noise-suppression construction has been also conceived for the purpose of achieving an easy and cheap decorative purpose so that the visual and/or aesthetic impact with respect to the environment where the construction is located may not be strong.

[0030] In addition, the present invention aims at conceiving a noise-suppression construction having reduced overall costs for manufacture, setting and servicing, and a practically unlimited operating life.

[0031] The technical task mentioned and the aims specified are substantially achieved by a noise-suppression construction having the features set out in one or more of the appended claims.

[0032] Description of a preferred but not exclusive embodiment of a noise-suppression construction in accordance with the invention is now given hereinafter by way of nonlimiting example, with the aid of the accompanying drawings, in which:

- Fig. 1 is a perspective view of a noise-suppression construction in accordance with the present invention;
- Fig. 2 is a section of a component of the construction in accordance with the present invention taken along line II-II in Fig. 1;
- Fig. 3 is a section of a component of the present noise-suppression construction taken along line III-III in Fig. 1;
- Figs. 4 and 5 show sectional views of some components of the present noise-suppression construction under assembled conditions;
- Fig. 6 shows some components of the present noise-suppression construction disposed in side by side relationship in accordance with a particular assembling modality;
- Fig. 7 shows sectional views of some alternative embodiments of components of the present noise-suppression construction;
- Fig. 8 is a sectional view of an alternative embodiment of the component shown in Fig. 2; and
- Fig. 9 is a sectional view of panel coupling in an angled region.

[0033] With reference to the drawings, the noise-suppression construction in accordance with the invention is generally denoted by reference numeral 1.

[0034] It substantially consists of a predetermined number of active elements 2 which are associable along at least one predetermined mutual-approaching direction; at the same time, construction 1 extends along a

predetermined laying direction (that is practically defined by the extension direction on the ground of the construction 1 itself).

[0035] It should be noted, at this point, that within the scope of the present invention, by the expression "mutual-approaching direction" it is intended the direction along which the different components of construction 1 are moved close to each other and disposed in a mutually assembled condition. As will be explained in more detail in the following, a particularly innovative and original aspect of the present invention is exactly represented by the particular choice of the mutual-approaching direction (that in the above described noise-suppression barriers of known type is practically given by the vertical piling direction, from top to bottom, of the sets of panels).

[0036] Advantageously, one or more of the active elements 2 can be made (at least partly) of a composite material comprising a plurality of resistant fibres buried in a matrix; depending on current requirements, it is possible to select the fibre and matrix typology so as to ensure the different mechanical features each time. For example, in accordance with a particularly appreciated embodiment of the present invention the active elements 2 can be made of glass fibre with a thermosetting polymeric matrix (although aramidic and/or carbon fibres can also be used).

[0037] In more detail, the active elements 2 first of all comprise a predetermined number of main panels 2a that are mutually associable in the assembled condition of construction 1. As it is possible to see from the accompanying figures, substantially these main panels 2a are elements of planar conformation (but, if wished, they can have curved portions as shown in the example in Fig. 8) and consequently they have a first face (facing a noise source under operating conditions of construction 1), a second face 4 opposite to the first face 3 and two side walls 5 extending between the first and second faces 3 and 4. Advantageously, in order to ensure satisfactory properties of damping the acoustic energy, these main panels further comprise at least one inner gap or empty space (designed to house a given amount of sound-absorbent/acoustic insulation material such as rock wool or others, for example).

[0038] Still looking at the figures, it is possible to see that practically the sizes of the first and second faces 3 and 4 are much bigger than the sizes of the side walls, and it is also possible to see that practically the main panels 2a have a major extension substantially standing up upright with respect to the ground; obviously, the proportions of the main panels 2a can be varied in any manner.

[0039] It is also to be noted that the major vertical extension of the main panels 2a enables piling in a vertical direction of the individual components (as seen in the known art) to be avoided; in fact, due to its important extension in height, with a single panel an important portion of the whole vertical extension of the construction 1 can be covered.

[0040] In addition, due to the conformation of the main panels, vertical piling of the panels can be advantageously avoided, since said panels can be easily disposed close to each other in directions lying in a substantially horizontal plane.

[0041] In accordance with the present invention, one or more main panels 2a (or even all of them, according to the preferred embodiment herein disclosed) comprise interlocking means 6 that are conveniently formed in the side walls 5 and are designed to interlock each main panel 2a with at least one, and preferably two adjacent main panels 2a. (In other words, due to the presence of the interlocking means 6, the main panels 2a are disposed close to each other in a horizontal direction and will constitute the construction 1 that practically consists of a sequence of horizontally approached, or better approached, panels along the laying direction).

[0042] Advantageously, the interlocking means 6 is substantially active along operating directions substantially transverse (and preferably perpendicular) to the mutual-approaching and/or laying direction. For example, as can be viewed from the accompanying drawings, the mutual-approaching direction is substantially horizontal, whereas these operating directions (that, as will be also illustrated in the following, practically consist of the extension directions of the side walls 5) are substantially vertical.

[0043] In accordance with another particularly innovative and original feature of the present invention, the mutual-approaching direction and the laying direction (that, as already said, can be substantially horizontal) can even be coincident; at all events, due to the particular geometric features of the components of the present invention, assembling of the main panels 2a may also take place by inserting them along the laying direction and in a sequence that will constitute the construction 1, by making them rotate about an ideal axis comprised in the vertical plane defined by the construction 1 itself (this rotation is exemplified by arrows "F" in Fig. 5); this assembling modality is made possible due to the particular building architecture of the interlocking means 6 that will be described in more detail below.

[0044] The interlocking means 6 comprises a predetermined number of abutment surfaces 6a that are disposed along a predetermined geometric sequence. This geometric sequence can be of any type, provided the shape of the abutment surfaces 6a belonging to a first main panel 2a matches and/or is complementary to that of the corresponding abutment surfaces 6a of a main panel 2a following or preceding such first main panel 2a (along the construction laying direction). In other words, the abutment surfaces 6a can be made by a succession of flat and/or curved faces (and also by any succession of angles and/or cusps and/or sharp-cornered points), provided a perfect matching or complementarity is ensured between two sequences of abutment surfaces belonging to two main panels 2a disposed close to each other.

[0045] It is also to be noted that, in accordance with the present invention, the presence of these abutment surfaces 6a ensures a high modular level to the different components of construction 1; in addition a single main panel 2a carries two series of abutment surfaces 6a thereon (each of which lies on the two opposite side walls 5); thanks to maintenance of complementarity, these sets of abutment surfaces 6a are substantially identical (and this will enable mounting of panel 2a irrespective of the panel orientation, since the just described structural features give the latter a high symmetry degree).

[0046] In detail, the abutment surfaces comprise at least one first abutment face which is substantially transverse (and preferably perpendicular, as shown in the accompanying drawings) to at least the first face 3 (or the second face 4) of the main panel 2a; after this first abutment face there is at least one second abutment face, which on the contrary will be substantially transverse (and preferably perpendicular) to the first abutment face.

[0047] Practically, in the first preferred embodiment herein shown, the second abutment face is substantially parallel to the first face 3 and the second face 4 (that are mutually parallel), whereas the first abutment face is practically perpendicular to the first and second faces 3 and 4. More generally, in the present invention the abutment surfaces are provided to define an abutment area; such an abutment area advantageously has a substantially stepped configuration (i.e. comprising a series of steps or at all events of solid angles of substantially convex configuration) and practically it comprises a sequence of abutment faces mutually defining a given solid angle (that can be a right angle, for example).

[0048] To be remembered is also the fact that, due to the particular conformation of the interlocking means 6, two panels can be disposed close to each other and assembled so as to form angular regions of the noise-suppression construction 1 (as shown in Fig. 6 and in Fig. 9, for example).

[0049] In accordance with the present invention, two mutually facing and adjacent abutment areas (belonging to two main panels 2a disposed in side by side relationship with, and adjacent to each other, for example) define a tortuous path that is advantageously suitable to damp and/or inhibit an acoustic energy flow between two main panels 2a (at the junction regions between the panels 2a themselves).

[0050] In accordance with the present invention, the noise-suppression construction 1 can be completely defined by a suitable number of main panels 2a; at all events, if more structural stability is wished to be given to construction 1, the presence of a predetermined number of posts 2b may be conveniently provided in the active elements 2.

[0051] These posts are associable with a given number of main panels 2a and can be linked to the ground in the assembled condition of construction 1

(practically they emerge at least partly from the ground and are partly anchored thereto). As can be seen in the figures, posts 2b are substantially interposed between two main panels 2a disposed in sequence along the laying direction.

[0052] Posts 2b can generally have a tubular or in any case prismatic conformation; conveniently the prevailing extension of these posts 2b will be along the major-side direction of the main panels 2a.

[0053] The transverse section of posts 2b can be of any nature, based on current requirements, provided said posts are equipped with engagement means 7 designed to be connected with the corresponding interlocking means 6 of the main panels 2a (in the assembled condition of construction 1).

[0054] Advantageously, in order to maintain a high modular level and great operating flexibility, the shape of the engagement means 7 preferably matches with and/or is complementary to the shape of the interlocking means 6; in this manner, the approaching and interlocking modalities between main panels 2a and posts 2b are substantially the same.

[0055] At this point it will be appreciated that depending on the arrangement of the engagement means 7 on posts 2b, a great variety of structural possibilities can be advantageously defined for construction 1 (that in these cases will have a laying direction that is not only merely rectilinear, but can comprise any number of angles and/or changes of direction). For example, the engagement means 7 may comprise given geometric sequences of engagement faces (substantially matching and/or being complementary to the sequence of abutment faces in the main panels 2a), disposed on substantially opposite faces of post 2b (and preferably parallel faces as shown in Fig. 4, where practically post 2b has a section comprising a substantially quadrangular core).

[0056] Due to such an arrangement of the engagement means 7, post 2b can be secured to two main panels 2a that are substantially parallel to (or aligned with) each other along the laying direction.

[0057] On the other hand, it is possible for the engagement means 7 to further comprise a predetermined geometric sequence of engagement faces disposed on consecutive faces, and preferably forming a predetermined solid angle, of post 2b (for example, in Fig. 7 engagement means 7 formed on two consecutive sides of the quadrangular core of post 2b can be seen); in this case, post 2b can be fastened to two main panels 2a that are substantially angled with respect to each other along the laying direction, and therefore the extension of construction 1 can be varied (in order to follow the contour of a parking area or other, for example).

[0058] By virtue of the particular arrangements of the engagement means, the present invention also enables innovative and original building architectures to be achieved for the noise-suppression construction 1: for example, by arranging the engagement means on all sides of post 2b, a construction 1 having several laying

directions radially diverging from post 2b can be made; in addition, it is also possible to dispose two or more posts 2b close to, and interlocked with each other, thus obtaining a very rigid load bearing structure and at the same time keeping the possibility of interfacing such a load bearing structure with the main panels 2a.

[0059] Furthermore, it is also to be noted that due to the correspondence between the engagement means 7 and interlocking means 6, tortuous paths (also referred to as acoustic labyrinths) can be defined, that succeed in effectively abating noise propagation even at the junction regions between the posts 2b and main panels 2a. In other words, the engagement means 7 together with the interlocking means 6 define a tortuous path designed to damp and/or inhibit the acoustic energy flow between at least one main panel 2a and one post 2b.

[0060] In order to optimize the acoustic-insulation properties, in the present invention the presence of a predetermined number of acoustic-seal elements 8a is provided, which elements are designed to be interposed between the main panels 2a and/or posts 2b (where they practically act as reflecting and/or damping fronts in the tortuous paths obtained by interfacing the components of construction 1).

[0061] Still for the purpose of reaching a high efficiency in abating the transmitted noise, the presence of acoustic damping elements 8b is provided in accordance with the present invention; these acoustic damping elements 8b can be formed on posts 2b and/or the main panels 2a and are active on the sound waves to damp the energy content thereof (through creation of a destructive interference on sound waves having predetermined frequencies, for example). According to a particularly appreciable embodiment of the present invention, these acoustic damping elements 8b substantially consist of a plurality of holes (suitably spaced apart from each other and of calibrated sizes based on requirements) formed in the first and/or second face 3, 4 of the main panels 2a.

[0062] For the purpose of ensuring interlocking stability and structural coherence to construction 1, the present invention further comprises retaining elements 2c, which are operatively associable with the main panels 2a and/or posts 2b; in other words, these retaining elements 2c are designed to prevent the main panels 2a from relatively moving away along the operating directions.

[0063] In the preferred embodiment herein shown, the retaining elements 2c substantially comprise a lower rib placed under a predetermined number of main panels 2a and an upper rib substantially placed above a predetermined number of main panels. These ribs extend between two posts 2b in succession along the laying direction and can advantageously be made at least partly of a material comprising a plurality of resistant fibres buried in a matrix (glass fibre in a thermosetting polymeric matrix, for example).

[0064] The rib presence is sufficient to prevent any

degree of freedom of the present construction 1; in any case, depending on current requirements the components of the present invention can be linked together by devices of the traditional type such as through screws, self-tapping screws, rivetting, glueing and so on (as shown in the example in Fig. 4).

[0065] Should a particularly strong engagement in the ground be required (or should a construction 1 of important height be installed), the present invention advantageously envisages the presence of a predetermined number of reinforcing elements 9 which are intended for engagement into the ground and with the posts 2b. In accordance with a particularly appreciated embodiment of the present invention, said reinforcing elements 9 consist of elongated elements (metal or composite material bars, for example) having a predetermined extension in the direction emerging from the ground; the extension in height of these reinforcing elements 9 can be less than that of the posts.

[0066] Through exploitation of the presence of the reinforcing elements 8, the noise-suppression construction 1 of the invention can be fastened following a particular modality; in fact, one or more reinforcing elements 9 can be inserted into the ground (or into a foundation formed in the ground), which elements 9 will partly emerge therefrom so that posts 2b and/or the main panels 2a can be exactly fitted on that portion of the reinforcing elements 9 emerging from the ground (i.e. without partly driving panels 2a and/or posts 2b into the ground or the foundation). This construction typology is particularly useful where a deep insertion into the ground is impossible, at elevated roads or bridges for example. It will be understood that in this case the main panels 2a and/or posts 2b practically are in contact with the ground but do not penetrate thereinto.

[0067] Manufacture of the different components of the present invention can conveniently take place following widely experienced technologies; in particular the main panels 2a and/or posts 2b and/or retaining elements 2c (and even the reinforcing elements 9 or the acoustic-seal elements 8a) can be built by means of a drawing operation (preferably by pultrusion and/or extrusion).

[0068] Construction 1 can be advantageously provided with ornamental elements, which can be associated with at least the main panels 2a and/or posts 2b (or more generally, with one or more components of the construction itself).

[0069] According to a particularly innovative and original feature of the invention, at least part of the fibres constituting the main panels 2a and/or posts 2b may for example have a given number of portions exhibiting a predetermined succession of chromatic shades. Conveniently, these fibres (or better, this multiplicity of such fibres) disposed close to each other according to predetermined combinations of said portions will be able to define said ornamental elements. In this case, the different components can be made through a particular production process involving, during the forming step of

panels 2a and/or posts 2b (or at all events of the construction components), an operating step in which the fibres before being passed through the forming implement of an extrusion or pultrusion plant, are submitted to dyeing, following predetermined patterns and chromatic sequences. Once the fibres have been suitably disposed close to each other and after they have been introduced into the matrix, a series of ornamental elements will be defined that practically consist of a predetermined combination of the different coloured portions. In this case, in accordance with the present invention, advantageously the matrix forming the main panels 2a and/or posts 2b will comprise an at least partly transparent material, so that the ornamental elements are made visible (while being partly covered with and protected by the resin itself).

[0070] On the other hand, it is also possible for the ornamental elements to be formed, in accordance with the present invention, of appropriate laminar elements, such as films or previously printed fabrics, for example; these laminar elements are conveniently inserted in the main panels 2a and/or posts 2b during the forming step, following production technologies known by themselves (by coextrusion or co-pultrusion, for example).

[0071] Within the scope of the present invention it is then possible to make structures different from traditional sound-suppression barriers placed along the streets; in fact, by conveniently exploiting the modular character of the main panels 2a and posts 2b, constructions of a closed outline can be defined that practically can form acoustic insulation/sound absorbent booths (that advantageously can be employed so as to abate propagation of noise generated by fixed sources).

[0072] The invention achieves important advantages.

[0073] In fact, the particular selection of the material for manufacture of the different components of the construction involves great advantages in terms of mechanical and lightness-in-weight properties; this, on the one hand, makes the assembling and/or disassembling operations simple and easy but, on the other hand, has beneficial effects in the logistic field as well (in fact it is possible to arrange several parts of a construction in a preassembled condition, which parts can be then easily transported and handled in the setting or laying place).

[0074] In addition, the reduced weight enables installation of the inventive construction on bridges or elevated roads as well, without the existence of static loads of great intensity resting thereon.

[0075] Nevertheless, non negligible is also the fact that the material of which the construction of the invention is made also offers important advantages as regards electric insulation, immunity against external agents, waterproofness, resistance to corrosion and radio lucency; in addition, in the case of the present invention the resistance to impacts is greatly better than with traditional materials. Furthermore, the composite material of which the different components of construction 1 are made is practically exempt from thermal expansion

phenomena.

[0076] Besides the intrinsic advantages of the present invention resulting from the material selection, also important is the fact that the particular construction architecture of the different components enables a great freedom of choice in laying the components themselves; in addition, due to the particular interfacing and connection modalities between the components themselves, assembling and disassembling of a single panel can be done without being obliged to act on the others.

[0077] Furthermore, the great modular character achieved between the components of the present invention enables installation of construction 1 also when complicated outlines in plan view are wished to be followed (so as to form successions of angles, for example). At the same time, the interlocking typology between the components of this construction offers a great hindrance to noise propagation also at the junction regions.

[0078] It is also to be pointed out that within the scope of the invention it is possible to apply ornamental or decorative patterns in a particularly easy and quick way, and also in an innovative and original manner; this is obviously advantageous for achieving an agreeable aesthetic appearance (or an improved dissimulation of the noise-suppression construction in the environment).

[0079] It will be also recognized that the material selection, construction architecture and laying flexibility also involve important simplifications from a logistic point of view, enabling easy transport and handling of individual components or even previously assembled full sections. Ultimately, all that has beneficial repercussions on the practical working capability and abatement of costs.

[0080] Also important is the fact that the present invention enables a very high efficiency in noise absorption and abatement, because on the one hand it enables an optimal filling of the cavities of the different components with acoustic insulation/sound absorbent material (also at the junction regions) and, on the other hand, also enables an efficient noise suppression through the interlocking regions between the different components as well.

[0081] The present invention also involves several advantages from an aesthetic point of view, because it can be easily provided with ornamental elements; in addition, the particular nature of these ornamental elements but above all positioning of same in the components of the sound-suppression construction makes them have an almost unlimited duration (in fact, the resin acting as the matrix completely covers the ornamental elements while leaving them in sight and in this way effectively protects them against atmospheric agents and dangerous objects.

Claims

1. A noise-suppression construction comprising a pre-

determined number of active elements (2) to be associated along at least one predetermined mutual-approaching direction, said construction (1) extending along a predetermined laying direction, **characterized in that** at least one of said active elements (2) is at least partly made of a material comprising a plurality of resistant fibres buried in a matrix.

2. A construction as claimed in claim 1, **characterized in that** at least part of the active elements (2) is made of a glass fibre and/or aramidic fibres and/or carbon fibres, said matrix preferably consisting of a polymeric material and more preferably a thermosetting polymeric material.

3. A construction as claimed in claim 1 or 2, **characterized in that** the active elements (2) comprise a predetermined number of main panels (2a) to be mutually associated under assembled conditions of the construction (1), at least one of said main panels (2a) being an element of preferably planar conformation and having a first face (3) facing a noise source under operating conditions of the construction (1), a second face (4) opposite to said first face (3), and at least one, and preferably two, side walls (5) extending between the first face (3) and said second face (4), said at least one main panel (2a) most preferably further comprising at least one empty space designed to house a predetermined amount of sound absorbent/acoustic insulation material.

4. A construction as claimed in claim 3, **characterized in that** said main panel (2a) comprises interlocking means (6), preferably formed in said side walls (5), designed to interlock said main panel (2a) with at least one and preferably two adjacent main panels (2a).

5. A construction as claimed in claim 4, **characterized in that** said interlocking means (6) is substantially active along operating directions substantially transverse and preferably perpendicular to said mutual-approaching direction and/or laying direction, said operating directions being preferably vertical, the mutual-approaching and/or laying directions being preferably substantially horizontal and more preferably coincident.

6. A construction as claimed in claim 4 or 5, **characterized in that** the interlocking means (6) comprises a predetermined number of abutment surfaces (6a) disposed in a predetermined geometric sequence, the shape of abutment surfaces (6a) belonging to a first main panel (2a) substantially matching and/or being complementary to the shape of abutment surfaces (6a) of a main panel (2a) following or preceding said first main panel (2a) in said

laying direction of the construction (1).

7. A construction as claimed in claim 6, **characterized in that** said abutment surfaces comprise at least one first abutment face substantially transverse and preferably perpendicular at least to the first face (3) and/or the second face (4) of the main panel (2a) and at least one second abutment face sequentially following said first abutment face and substantially transverse, preferably perpendicular to the latter, said second abutment face being most preferably parallel to the first face (3) and/or the second face (4).
8. A construction as claimed in claim 7, **characterized in that** the abutment surfaces define an abutment area having a substantially stepped configuration, said abutment area comprising a sequence of abutment faces mutually defining a predetermined solid angle, said solid angle being preferably a right angle, two mutually-facing and adjacent abutment areas defining a tortuous path designed to damp and/or prevent a flow of acoustic energy between two main panels (2a).
9. A construction as claimed in anyone of the preceding claims, **characterized in that** the active elements (2) further comprise a predetermined number of posts (2b) to be associated with a predetermined number of main panels (2a), said posts (2b) preferably being adapted to be fastened to the ground under assembled conditions of the construction (1), and more preferably being interposed between two main panels (2a) disposed in sequence in the laying direction.
10. A construction as claimed in claim 9, **characterized in that** at least one of the posts (2b) comprises engagement means (7) intended for engagement with corresponding interlocking means (6) of the active elements under assembled conditions of the construction (1), the shape of said engagement means (7) preferably matching and/or being complementary to that of the interlocking means (6), the engagement means (7) together with the interlocking means (6) preferably defining a tortuous path designed to damp and/or prevent an acoustic-energy flow between at least one main panel (2a) and one post (2b).
11. A construction as claimed in claim 10, **characterized in that** the engagement means (7) comprises a predetermined geometric sequence of engagement faces disposed on substantially opposite and preferably parallel faces of the post (2b), the post (2b) being adapted to be connected to two main panels (2a) substantially parallel to and/or aligned with each other in the laying direction.
12. A construction as claimed in claim 9 or 10, **characterized in that** the engagement means (7) further comprises a predetermined geometric sequence of engagement faces disposed on consecutive faces of the post (2b) and preferably forming a predetermined solid angle, the post (2b) being adapted to be connected to two main panels (2a) that are substantially angled with respect to each other in the laying direction.
13. A construction as claimed in anyone of the preceding claims, **characterized in that** it further comprises a predetermined number of acoustic-seal elements (8a) designed to be interposed between main panels (2a) and/or between posts (2b).
14. A construction as claimed in anyone of the preceding claims, **characterized in that** it further comprises acoustic damping elements (8b) formed on the posts (2b) and/or the main panels (2a) and active on sound waves to damp the energy content thereof, said acoustic damping elements (8b) preferably consisting of a plurality of holes formed in the first and/or second face (3, 4) of the main panels (2a).
15. A construction as claimed in anyone of the preceding claims, **characterized in that** it further comprises retaining elements (2c) to be operatively associated with the main panels (2a) and/or the posts (2b), said retaining elements (2c) being preferably designed to prevent relative displacements of the main panels (2a) along said operating directions.
16. A construction as claimed in claim 15, **characterized in that** the retaining elements (2c) comprise at least one lower rib substantially placed under a predetermined number of main panels (2a) and at least one upper rib substantially placed above a predetermined number of main panels, said lower and/or upper ribs preferably extending between two posts (2b) in succession along the laying direction and more preferably being made at least partly of a material comprising a plurality of resistant fibres buried in a matrix.
17. A construction as claimed in anyone of the preceding claims, **characterized in that** it further comprises a predetermined number of reinforcing elements (9) intended for engagement into the ground and with the posts (2b), said reinforcing elements (9) preferably consisting of elongated elements having a predetermined extension in a direction emerging from the ground.
18. A construction as claimed in anyone of the preceding claims, **characterized in that** the matrix constituting the main panels (2a) and/or the posts (2b) comprises an at least partly transparent material.

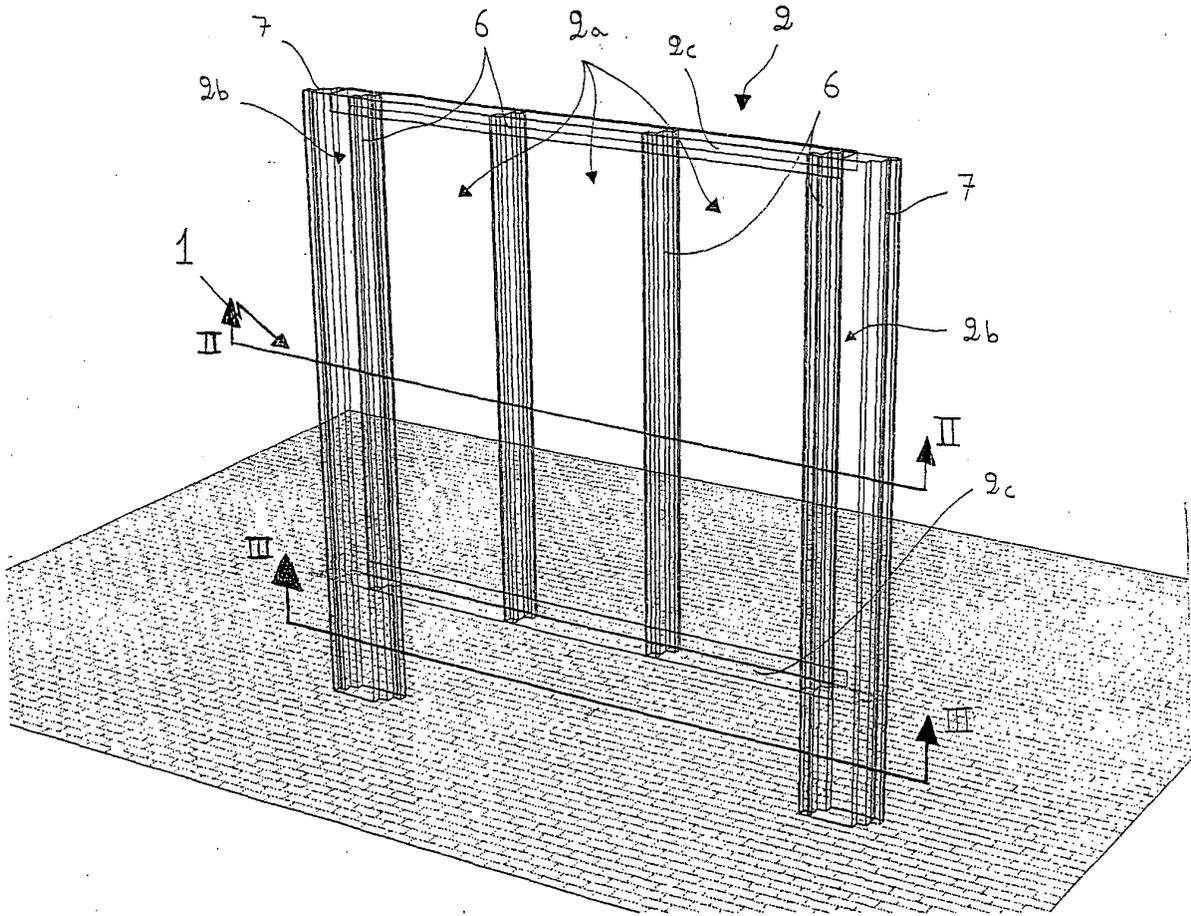
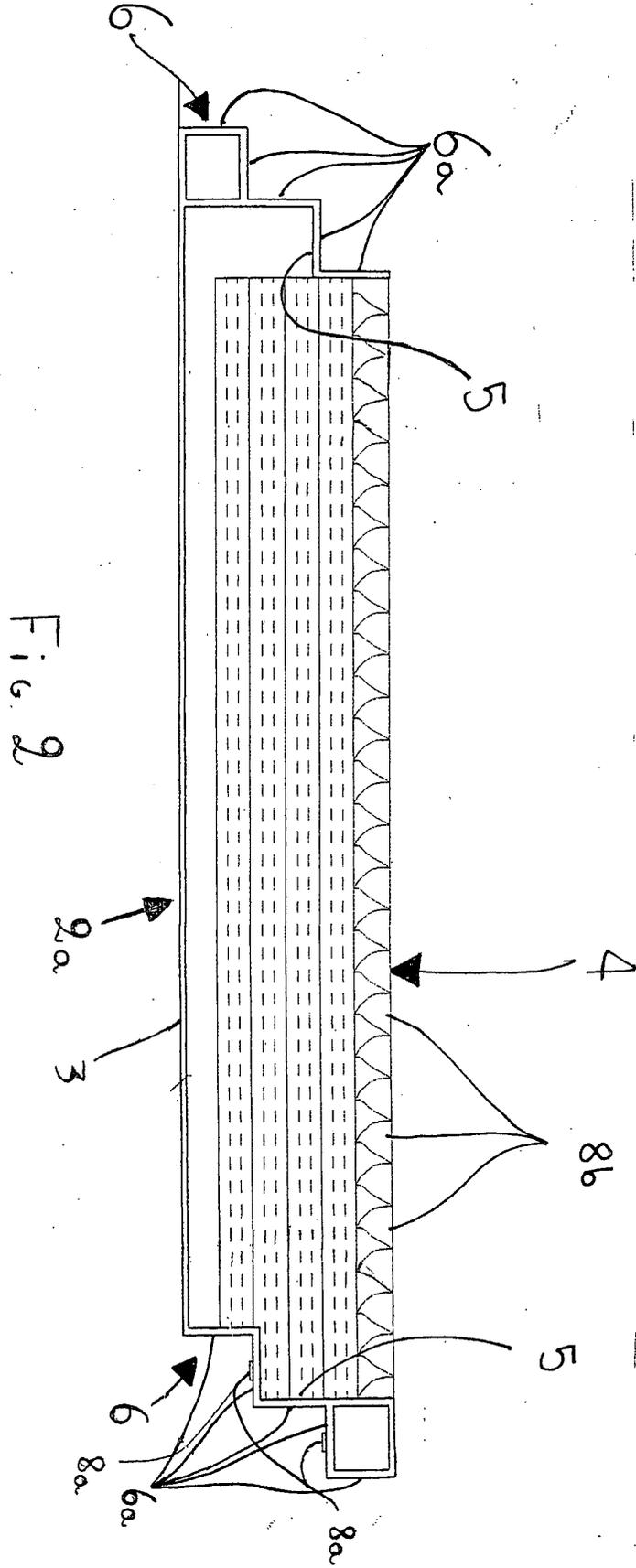


Fig. 1



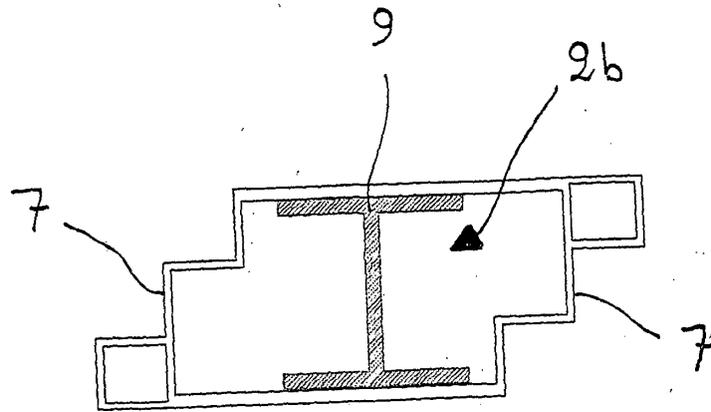


Fig. 3

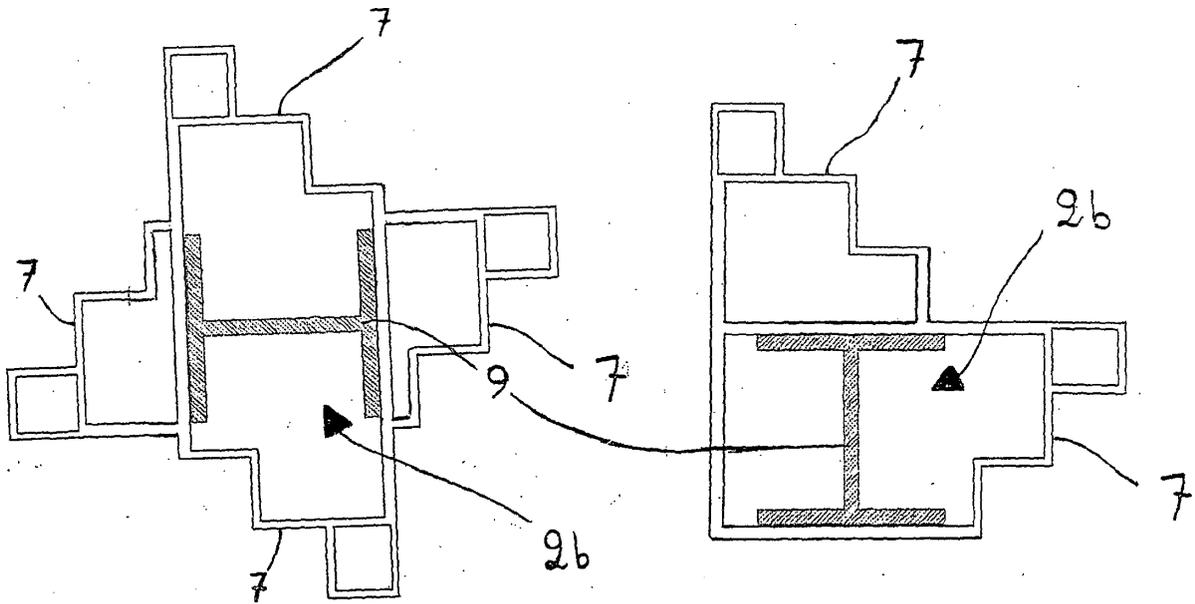
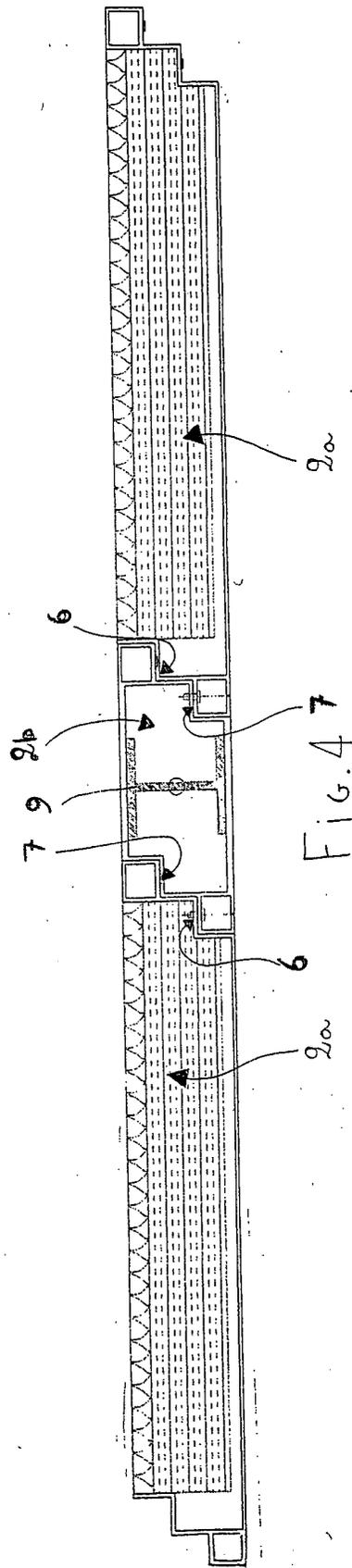


Fig. 7



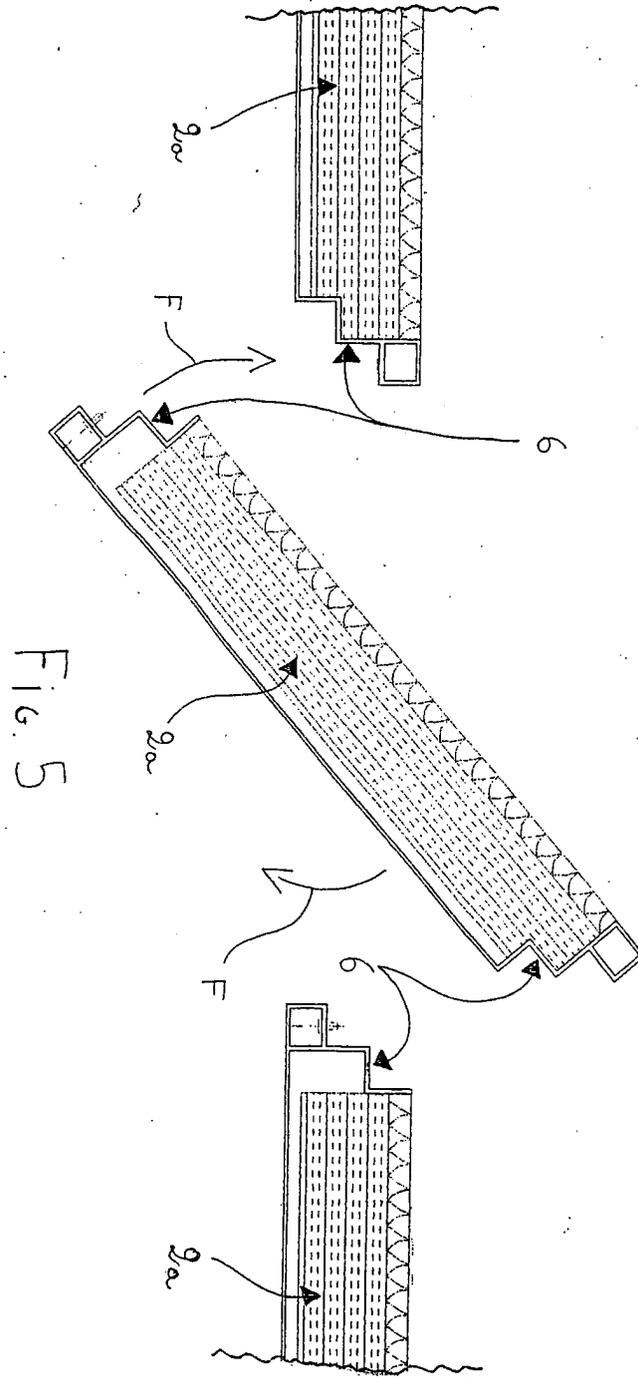


Fig. 5

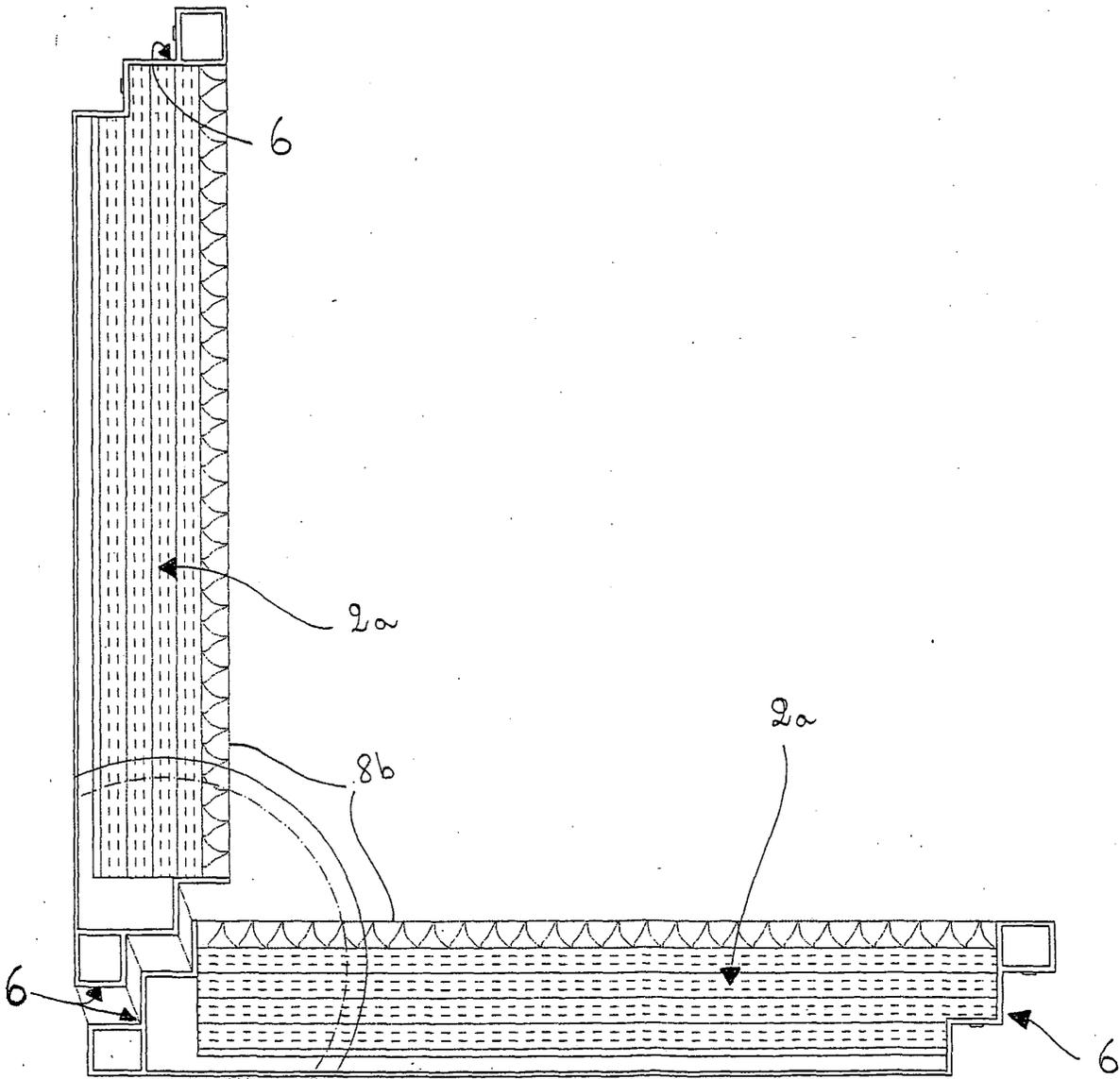


Fig. 6

FIG. 8

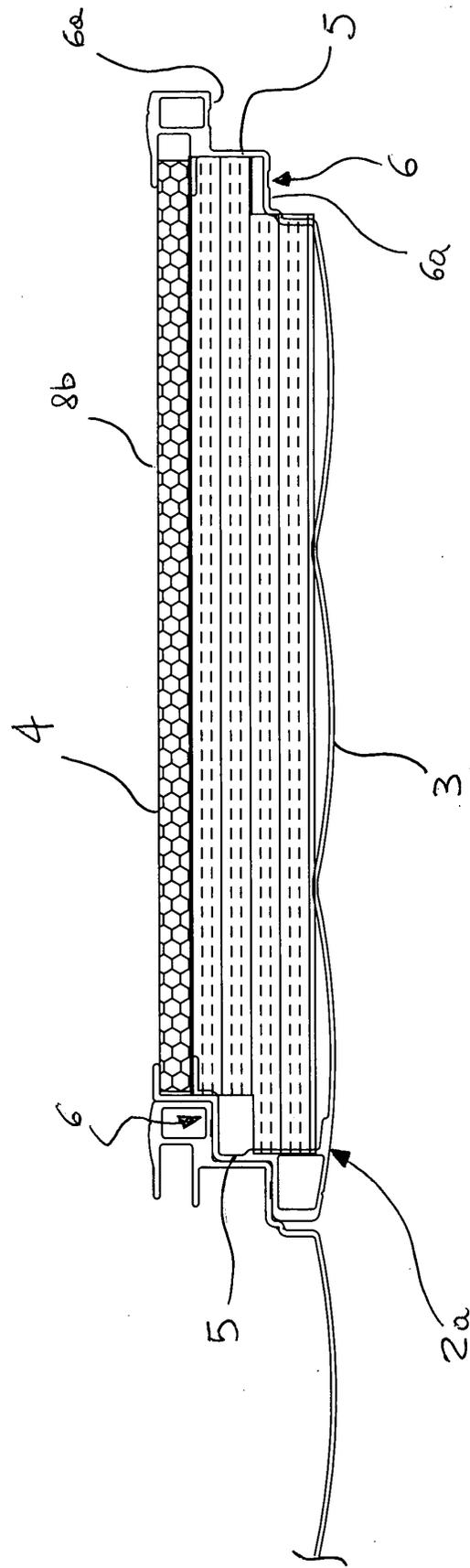
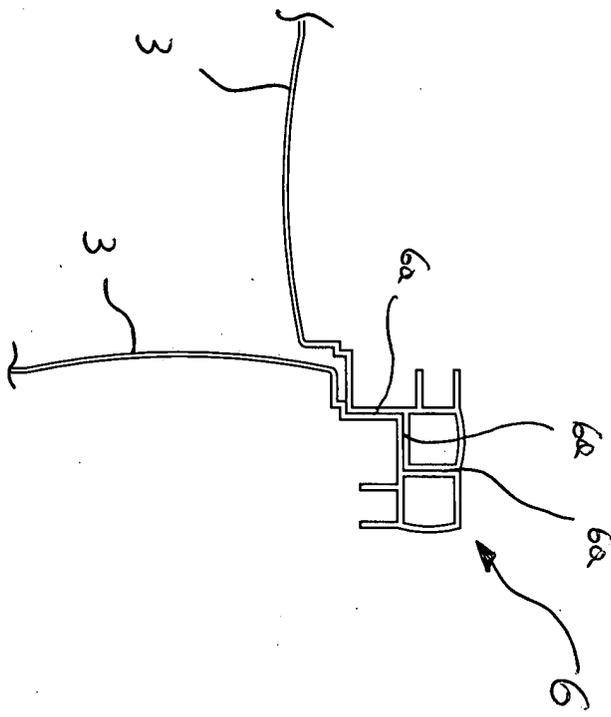


FIG. 9





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	EP 0 962 593 A (MOSTERT DE WINTER B V) 8 December 1999 (1999-12-08) * column 3, line 33 - column 4, line 16; figure 2 *	1-18	E01F8/00
Y	US 6 412 597 B1 (MOLNAR GERALD ET AL) 2 July 2002 (2002-07-02) * column 4, line 48 - line 51; figure 1 *	1-18	
A	US 5 372 866 A (SEELMAN PETER ET AL) 13 December 1994 (1994-12-13) * column 2, line 5 - line 8; figure *	1-18	
A	PATENT ABSTRACTS OF JAPAN vol. 015, no. 358 (M-1156), 10 September 1991 (1991-09-10) & JP 03 140508 A (DAITO KEMITORONIKUSU KK), 14 June 1991 (1991-06-14) * abstract *	1,2	
A	FR 2 478 698 A (PROCI SA) 25 September 1981 (1981-09-25) * page 5, line 33 - page 6, line 11; figure 3 *	4-8, 10-13	
A	DE 44 35 575 A (LINGEN PAUL) 11 April 1996 (1996-04-11) * column 1, line 3 - column 2, line 25; figure 6 *	3-8, 13-16	E01F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17 July 2003	Examiner Severens, G
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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 03 00 2712

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-07-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0962593	A	08-12-1999	NL 1009264 C2 EP 0962593 A1	29-11-1999 08-12-1999
US 6412597	B1	02-07-2002	AU 5981299 A DE 19947704 A1 WO 0020690 A1 EP 1119662 A1 JP 2002526802 T	26-04-2000 13-04-2000 13-04-2000 01-08-2001 20-08-2002
US 5372866	A	13-12-1994	DE 4130467 A1 AT 131887 T DE 59204745 D1 DK 531982 T3 EP 0531982 A1 ES 2081014 T3 HK 12697 A JP 3345051 B2 JP 5214713 A	18-03-1993 15-01-1996 01-02-1996 29-01-1996 17-03-1993 16-02-1996 14-02-1997 18-11-2002 24-08-1993
JP 03140508	A	14-06-1991	NONE	
FR 2478698	A	25-09-1981	FR 2478698 A1	25-09-1981
DE 4435575	A	11-04-1996	DE 4435575 A1	11-04-1996