

BUILDING ELEMENT

The invention concerns a structural member consisting of two parallel welded wire mesh mats, straight web wires which keep the wire mesh mats at a predetermined distance from each other and are connected at each end to the two wire mesh mats, and an insulating body which is arranged with its top and bottom surfaces parallel to the wire mesh mats and at a predetermined distance therefrom and through which pass the web wires.

From US-B-4,454,702 is known a structural member comprising an insulating body which is provided with some through-holes each reinforced by a spacer wire. This structural member is first constructed on site from the individual components such as wire mesh mats, insulating body and spacers and finally surrounded in concrete on the wire mesh mats on both sides. In this case the through-holes are also filled with concrete, so that a connection is made between the two concrete walls. A disadvantage with this method of production is that the structural member is constructed only on site and the number and dimensions of the through-holes are not specified in more detail.

It is the object of the invention to avoid the drawbacks described for the known structural members and to provide a structural member which is supplied to the site already prefabricated and, in addition to good heat insulation values, exhibits good sound insulation values over the whole audible frequency range. The structural member is moreover to be capable of being made easily and rapidly adapted to different static requirements. Further the structural member is to allow the selection of various materials for the insulating body and facilitate application of the concrete layer at the point of use of the structural member. The structural member according to the invention is distinguished by the fact that at least one straight through-hole is formed in the insulating body between the top and bottom surfaces.

Within the scope of the invention the or at least one

through-hole extends perpendicularly to the top and bottom surfaces of the insulating body. According to another characteristic of the invention the or at least one through-hole can extend at a predetermined angle obliquely to the top and bottom surfaces of the insulating body, wherein the through-hole extends, when the structural member is used as a vertical wall element, obliquely downwards. Preferably in this case each oblique through-hole extends parallel to the longitudinal wires and/or parallel to the cross wires of the wire mesh mats.

According to the invention each through-hole has a round cross-section with a diameter within the range from 50 to 100 mm.

According to another characteristic of the invention at least one of the wire mesh mats is constructed as a mesh reinforcing mat having a minimum strength of weld junctions that meets the static requirements of the structural member, corresponding mechanical strength of the mesh mat wires and also corresponding diameters and distances between the mesh mat wires, the web wires are arranged in predetermined directions relative to the wire mesh mats, and the insulating body is kept at a predetermined distance from each of the wire mesh mats.

The invention relates to a method for sheathing a structural member of the kind indicated above. With this method the procedure is such that to the outer wire mesh mat, which is designed to form the outside of the structural member, is applied a concrete outer shell which adjoins the insulating body or the separating layer adjacent to the outer wire mesh mat, surrounds the outer wire mesh mat and together with the latter forms the load-bearing part of the structural member, to the inner wire mesh mat, which is designed to form the inside of the structural member, is applied a concrete inner shell which adjoins the insulating body or the separating layer adjacent to the inner wire mesh mat, surrounds the inner wire mesh mat and together with the latter forms the load-

bearing part of the structural member, and at the same time each through-hole is filled with a concrete web which connects the concrete outer shell and the concrete inner shell in force-locking relationship.

With the invention, the structural member can be prefabricated at the factory and exhibits optimum sound and heat insulation values with a high load-carrying capacity.

Numerous further characteristics and advantages of the invention are apparent from the subsidiary claims and are described in more detail below by practical examples with reference to the drawings. They show: Fig. 1 a structural member according to the invention in a top view; Fig. 2 a section through the structural member according to Fig. 1 along the line II-II; Fig. 3 in an axonometric view a structural member according to the invention; Fig. 4 a side view of the edge region of the structural member according to Fig. 1 as seen in the direction of the cross wires; Figs. 5 to 9 side views of structural members according to the invention with different embodiments for the arrangement of the web wires within the structural member; Fig. 10 a side view of a structural member with asymmetrically arranged insulating body; Fig. 11 a side view of a structural member with additional edge web wires extending perpendicularly to the wire mesh mats; Fig. 12 a side view of a structural member with wire mesh mats which protrude laterally beyond the insulating body at the edge of the structural member; Fig. 13 a side view of a structural member with an insulating body provided with cavities; Fig. 14 in a schematic perspective view a structural member with an outer shell and an inner shell of concrete; Fig. 15 a detail of a section through a structural member according to Fig. 14; Fig. 16a a section through a structural member with a two-layer reinforcement, wherein in the outer shell is provided an additional reinforcing mat and the inner shell is made of concrete; Fig. 16b a section through a structural member with a two-layer reinforcement, wherein in the inner shell is provided an additional reinforcing

mat and the outer shell is made of concrete; Fig. 17 a section through a structural member with an outer shell made of concrete and with a lining panel on the inside of the structural member; Fig. 18 a side view of a structural member with an insulating body whose top and bottom surfaces are provided with recesses; Fig. 19 a side view of a structural member with an insulating body whose top and bottom surfaces are provided with transverse grooves; Fig. 20 a side view of a structural member with a plaster base mesh as well as with a separating layer on a top or bottom surface of the insulating body, and Fig. 21 a side view of a structural member with in each case two separating layers and two plaster base meshes as well as a layer of insulating material in between.

In Figs. 3 to 21 the through-holes have been omitted for the sake of greater clarity. The structural member shown in a top view in Fig. 1, in a section along line II-II in Fig. 2 and in an axonometric view in Fig. 3 consists of outer and inner wire mesh mats 1 and 2 respectively, which are arranged parallel to and at a predetermined distance from each other. Each wire mesh mat 1 or 2 consists of several longitudinal wires 3 or 4 and several cross wires 5 or 6 which cross each other and are welded together at the points of intersection. The distance between the longitudinal wires 3, 4 and between the cross wires 5, 6 is selected according to the static requirements of the structural member. The distances are preferably selected equal, for example within the range of 50 to 150 mm, so that the respectively adjacent longitudinal and cross wires form square holes. Within the scope of the invention the holes of the wire mesh mats 1, 2 can also be rectangular and have for example short side lengths of 50 mm and long side lengths within the range from 75 to 100 mm.

The diameters of the longitudinal and cross wires 3, 4 or 5, 6 are also selectable according to the static requirements and are preferably within the range from 2 to 6 mm. The surface of the wire mesh mats 3, 4, 5, 6 can be

smooth or ribbed within the scope of the invention.

The two wire mesh mats 1, 2 are joined together by several web wires 7, 7' into a dimensionally stable mesh body. The web wires 7, 7' are welded at their ends in each case to the wires of the two wire mesh mats 1, 2, wherein within the scope of the invention the web wires 7, 7' are welded either, as shown in Fig. 1, to the respective longitudinal wires 3, 4 or to the cross wires 5, 6. The web wires 7, 7' are arranged alternately in opposite directions obliquely, i.e. like a trellis, as a result of which the mesh body is reinforced against shear stress.

The distances between the web wires 7 and their distribution in the structural member depend on the static requirement of the structural member and are for example 200 mm along the longitudinal wires and 100 mm along the cross wires. The distances between the web wires 7, 7' in the direction of the mesh mat longitudinal wires 3, 4 and mesh mat cross wires 5, 6 are appropriately a multiple of the mesh division. The diameter of the longitudinal wires is preferably within the range from 3 to 7 mm, wherein in the case of structural members with thin longitudinal and cross wires the diameter of the web wires is preferably selected larger than the diameter of the longitudinal and cross wires.

The three-dimensional mesh body formed from the two wire mesh mats 1, 2 and the web wires 7 must not only be dimensionally stable, but also, in case of its preferred use as a wall and/or ceiling element, fulfil the function of a three-dimensional reinforcing element, i.e. take up shearing and compressive forces. Therefore both the longitudinal and cross wires are welded to each other, as is usual with reinforcing mats, and the web wires 7 are welded to the mesh mat wires 3, 4, 5, 6, keeping to the minimum strength of the weld junctions. In order to be able to fulfil the function of a three-dimensional reinforcing element, the mesh mat wires 3, 4, 5, 6 and the web wires 7 must be made of suitable materials and have

appropriate mechanical strength values so that they are usable as reinforcing wires for the wire mesh mats 1, 2 to be used as mesh reinforcing mats, or as reinforcing wires which connect the two wire mesh mats 1, 2.

Within the scope of the invention it is also possible to join the web wires 7, 7' at both their ends for example by tying plastic cords or lashing. Alternatively the web wires 7, 7' can be connected to the mesh mat wires 3, 4, 5, 6 in the above manner at one end and by welding at the other end.

In the gap between the wire mesh mats 1, 2, at a predetermined distance from the wire mesh mats is arranged an insulating body 8 whose top and bottom surfaces 9 and 9' run parallel to the wire mesh mats 1, 2. The insulating body 8 serves for heat and sound insulation and for example is made of foam plastics such as polystyrene or polyurethane foam, rubber-based foams, lightweight concrete such as autoclaved or porous concrete, porous plastics, rubber-based porous materials, compressed slag, compressed sludge, plasterboard panels, cement-bonded compressed boards which are made from wood chips, jute, hemp and sisal fibres, rice husks, straw waste, sugar cane waste, or mineral and glass wool, corrugated cardboard, compressed waste paper, bonded brick pieces, melted recyclable plastic waste, rushes and bamboo canes tied together. The insulating body 8 can within the scope of the invention also be made from bioplastics, for example algal foam which is made from foamed algae or algal cellulose.

The insulating body 8 can be provided with predrilled holes for receiving the web wires 7. The insulating body 8 can also be provided on one or both sides with a plastic or aluminium layer which serves as a vapour barrier. The position of the insulating body 8 in the structural member is fixed by the obliquely extending web wires 7 which pass through the insulating body 8.

The thickness of the insulating body 8 is freely selectable and is for example within the range from 20 to

200 mm. The distances from the insulating body 8 to the wire mesh mats 1, 2 are also freely selectable and are for example within the range from 10 to 30 mm. The structural member can be made in any length and width, wherein on the basis of the method of production a minimum length of 100 cm and standard widths of 60 cm, 100 cm, 110 cm, 120 cm have proved to be advantageous.

In the insulating body 8 are formed several through-holes 10, 11, 11' which extend perpendicularly and/or at a selectable angle in each case obliquely to the top and bottom surfaces 9, 9' of the insulating body 8. The through-holes 10, 11, 11' are drilled in the insulating body 8 or stamped out of it. Within the scope of the invention it is also possible to make the through-holes 10, 11, 11' during production of the insulating body by suitable shaping of the moulding tools. The directions of the obliquely extending through-holes 11, 11' are selected in such a way that, if the structural member is used as a vertical wall, at least the through-holes 11, 11' of one type extend obliquely downwards, wherein the directions run parallel to the longitudinal wires 3, 4 and/or parallel to the cross wires 5, 6 of the wire mesh mats 1, 2. The number, dimensions and distribution of all through-holes 10, 11, 11' are freely selectable. The number and dimensions should not be selected too large, in order not to impair too greatly the heat insulation values of the structural member. The number is for example between two and six per m². The shape of the through-holes 10, 11, 11' can also be selected as desired and may be for example square, rectangular or round. In case of a round cross-section of the through-holes 10, 11, 11' the diameters are preferably within the range from 50 to 100 mm. The distribution of the through-holes 10, 11, 11' in the structural member can be regular or random within the scope of the invention, wherein a random asymmetrical distribution of the through-holes 10, 11, 11' is advantageous to avoid resonance effects.

As can be seen from the top view of the structural member shown in Fig. 1, at the edge of the structural member the longitudinal wires 3 and the edge longitudinal wires 3' end in each case flush with the edge cross wires 5', and the cross wires 5 and the edge cross wires 5' end in each case flush with the edge longitudinal wires 3'. The same applies analogously to the mesh mat wires 4, 4', 6, 6' of the other wire mesh mat 2.

In Fig. 4 is shown a side view of the structural member seen in the direction of the cross wire assembly. In this case the web wires 7 extending alternately in opposite directions obliquely to each other form a row and are in each case welded to the corresponding longitudinal wires 3 or 4 of the wire mesh mat 1 or 2, which are arranged one above the other.

Figs. 5 and 6 show in each case practical examples with different angles between the web wires 7 and the corresponding longitudinal wires 3, 4 of the wire mesh mats 1, 2, wherein according to Fig. 5 different angles within a row of web wires are also possible within a structural member.

Fig. 7 shows a structural member in which in one row the web wires 7 extend in the same direction obliquely between the longitudinal wires 3 and 4 of the wire mesh mats 1, 2, while in the next row the web wires 7' shown in broken lines also extend in the same direction obliquely, but with opposite direction between the corresponding longitudinal wires, i.e. the structural member has several rows of oblique web wires in the same direction, with alternating direction from row to row. Within the scope of the invention the rows of web wires oriented in the same direction obliquely can also extend between the cross wires 5, 6 of the wire mesh mats 1, 2.

Fig. 8 shows a structural member with web wires 7 extending in opposite directions obliquely in each row, wherein the distances between adjacent web wires in the row are selected in such a way that the ends of the web wires

facing towards each other come as close as possible to each other, as a result of which if occasion arises two web wires can be welded jointly in one operation to the corresponding mesh wire.

Within the scope of the invention the web wires 7 can, as shown in Fig. 9, also be arranged perpendicularly to the wire mesh mats 1, 2. Since in this case the position of the insulating body 8 in the mesh body is fixed only inadequately by the web wires 7, several spacers 12 which are in each case supported on the corresponding mesh mat wires of the wire mesh mats 1, 2 are provided for fixing the insulating body 8. The spacers 12 are also used in structural members with obliquely extending web wires 7 if, on account of the material properties of the insulating body 8, fixing thereof in the mesh body is not ensured by the web wires. This applies for example to insulating bodies made of rushes or bamboo canes tied together.

As Fig. 10 shows, the insulating body 8 can also be arranged asymmetrically to the two wire mesh mats 1, 2. In this case the diameters of the mesh wires 4, 4', 6, 6' of the wire mesh mat 2 located further from the insulating body 8 are advantageously larger than the diameters of the mesh wires 3, 3', 5, 5' of the wire mesh mat 1 located closer to the insulating body 8.

To reinforce the mesh body at its edges, according to Fig. 11 additional edge web wires 13 preferably extending perpendicularly to the wire mesh mats 1, 2 and welded to the corresponding edge mesh wires 3', 4', 5', 6' of the wire mesh mats 1, 2 can be provided. The diameter of the edge web wires 13 is preferably equal to the diameter of the web wires 7, 7'.

In Fig. 12 is shown a structural member according to the invention, whose insulating body 8 does not end at the side surfaces 14 running parallel to the cross wires 5, 6 with the two wire mesh mats 1, 2, but the latter protrude laterally beyond them. Due to this embodiment, when two identical structural members are connected, the insulating

bodies of adjacent structural members can be arranged without a gap, while the wire mesh mats of the two structural members overlap each other and so form a load-bearing lap joint.

The insulating body 8 can also end flush with the inner wire mesh mat 2 at its two side surfaces 14 and protrude only beyond the wire mesh mat 1 which is the outer one in practical use.

One or both of the wire mesh mats can protrude laterally beyond the insulating body 8 at all side surfaces thereof as well. In these practical examples any edge web wires 13 can be arranged in such a way that they extend outside the insulating body 8 or adjoin it laterally.

The longitudinal and cross wires of the wire mesh mats 1, 2 as well as the web wires can have any cross-section. The cross-sections can be oval, rectangular, polygonal or square.

Fig. 13 shows a structural member comprising a two-part insulating body 8'. In this case if necessary the parts of the insulating body 8' can be adhered to each other at their contact surfaces. The two parts of the insulating body 8' for the purpose of saving material enclose cavities 15 which however can also be filled with other materials, for example pourable and flowable insulating materials such as wood and foam chips, sand, or plastic, rice or straw waste. The insulating body 8' may also consist of several parts which can be connected to each other, for example, have a multi-layer structure. It is further possible to provide a single-part insulating body 8 with cavities 15.

As shown schematically in Fig. 14, to the outer wire mesh mat 1 intended to form the outside of the structural member is applied an outer shell 16, for example of concrete, which adjoins the insulating body 8, surrounds the outer wire mesh mat 1 and together with the latter forms the load-bearing part of the structural member according to the invention. The thickness of the outer

shell 16 is selected according to the static as well as sound and heat insulation requirements of the structural member and is for example 20 to 200 mm. If the structural member is used as a ceiling element, for static reasons the minimum thickness of the outer shell 16 must be 50 mm.

To the inner wire mesh mat 2 intended to form the inside of the structural member is applied an inner shell 17 which adjoins the insulating body 8, surrounds the inner wire mesh mat 2 and for example is made of concrete or mortar. The thickness of the inner shell 17 is selected according to the static as well as sound and heat insulation requirements of the structural member and is for example 20 to 200 mm. The two shells 16, 17 are preferably applied at the point of use of the structural member, for example sprayed on in a wet or dry process.

In Fig. 15 is shown a section through the structural member according to the invention, which is provided with an outer shell 16 and an inner shell 17, the section corresponding to the section shown in Fig. 2. In this case the vertical through-holes 10 are filled each with a vertical concrete web 18 connecting the two concrete shells 16, 17, and the oblique through-holes 11, 11' are each filled with an also oblique concrete web 18' connecting the two concrete shells 16, 17. The concrete shells 16, 17 and the concrete webs 18, 18' can be made by spraying and/or casting methods.

As the parts of the web wires 7, 7' as well as if occasion arises of the edge web wires 13 located in the inside region of the structural member are not covered with concrete and therefore are subject to corrosion, the wires 7, 7' or 13 must be provided with an anti-corrosion layer.

This is preferably achieved by galvanisation and/or plastic coating of the wires 7, 7' or 13. To allow welding of the wires 7, 7' or 13 to the mesh wires of the wire mesh mats 1, 2, however, the plastic layer must not cover the end regions of the web wires 7, 7' or edge web wires 13. For reasons of cost it proved advantageous to use wire

already galvanised during manufacture of the mesh body, at least for the web wires 7, 7'. The wires 7, 7' or 13 can also be made of stainless steel grades or other non-corroding materials, e.g. aluminium alloys, wherein they must be capable of being connected, preferably welded, to the mesh wires of the wire mesh mats 1, 2. Within the scope of the invention the mesh mat wires 3, 3', 5, 5' of at least the outer wire mesh mat 1 can be provided with an anti-corrosion layer or made of stainless steel grades or other non-corroding materials. The anti-corrosion layer or the materials must have properties such that welding to the web wires 7, 7' as well as to the edge web wires 13 is possible without problems. The anti-corrosion layer may for example consist of a copper or zinc layer. Within the scope of the invention it is possible with the finished structural member, even before applying the outer and inner shells, to provide with an anti-corrosion layer at least the outer wire mesh mat 1 together with the regions of the web wires 7, 7' and edge web wires 13 protruding from the insulating body 8, 8'. This can be done for example by dipping the corresponding wire mesh mat 1 together with adjoining regions of the web wires 7, 7' and edge web wires 13 in an enamelling or galvanising bath.

For static reasons and/or to increase the sound insulation it may be necessary to provide the structural member on at least one side of the structural member with a very thick concrete shell with a two-layer reinforcement. In Fig. 16a is shown a detail of a structural member with a very thick concrete shell 16' made of concrete, wherein the outer shell 16' is reinforced with an outer additional reinforcing mat 19 whose distance from the outer wire mesh mat 1 is freely selectable according to the static requirements of the structural member. The outer additional reinforcing mat 19 prevents cracking caused by temperature and shrinkage stresses in the outer shell 16'.

The structural member may also for static reasons and/or to increase the sound insulation be provided with a

very thick inner shell 17', wherein the latter is reinforced either only with an inner wire mesh mat 2 or, as Fig. 16b shows, with an inner wire mesh mat 2 and an inner additional reinforcing mat 19'. The distance from the inner additional reinforcing mat 19' to the inner wire mesh mat 2 is freely selectable according to the static requirements of the structural member. The diameters of the mesh wires of the inner additional reinforcing mat 19' are preferably larger than the diameters of the mesh wires of the two wire mesh mats 1, 2 and are for example within the range from 3 to 7 mm. If the thick inner shell 17' is reinforced only with the inner wire mesh mat 2, the diameters of the mesh wires 4, 4', 6, 6' of the inner wire mesh mat 2 and of the web wires 7, 7' are preferably larger than the diameters of the mesh wires 3, 3', 5, 5' of the outer wire mesh mat 1 and are for example within the range from 5 to 6 mm.

The inner wire mesh mat 2 and the inner additional reinforcing mat 19' can be connected by several distance wires 20 which preferably extend perpendicularly to the inner wire mesh mat 2 and inner additional reinforcing mat 19' and whose mutual lateral spacing is freely selectable.

The diameter of the distance wires 20 is preferably equal to the diameters of the mesh wires of the wire mesh mats 1, 2.

Within the scope of the invention the outer additional reinforcing mat 19 and the outer wire mesh mat 1 can also be connected to distance wires which preferably extend perpendicularly to the outer wire mesh mat 1 and outer additional reinforcing mat 19. These distance wires are arranged with selectable lateral spacing from each other and have diameters which are preferably equal to the diameters of the mesh wires of the two wire mesh mats 1, 2.

The thick concrete shells 16' and 17' provided with two-layer reinforcement can also be cast from mix-in-situ concrete at the point of use of the structural member, the outer boundary of the concrete shells 16', 17' being formed

by shuttering, not shown.

As Fig. 17 shows, on the inner side of the structural member instead of the inner concrete shell 17 can be arranged a lining panel 21 which rests on the inner wire mesh mat 2 and is attached to an assembly aid 22. The lining panel 21 forms the non-load-bearing inner wall of the structural member and can, because it does not have to fulfil any static functions, be made of lightweight building material such as a plywood panel, a plasterboard panel and the like, and be designed decoratively according to wishes for fitting out the interior. The assembly aid 22 is arranged between the insulating body 8 and the inner wire mesh mat 2 and consists for example of several strips which extend between the web wires in a vertical direction if the structural member is used as a wall element. The assembly aid 22 can, if necessary, be attached to the wires 4 or 6 of the inner wire mesh mat 2, for example by means of staples, not shown, or to the insulating body 8, for example by means of an adhesive layer. The assembly aid 22 must be made of suitable material, for example wood, which ensures secure anchoring of the lining panel 21 to the inner wire mesh mat 2 in between. Due to the embodiment according to the invention, the lining panel 21 is not attached to the insulating body 8, which of course on account of its material properties does not permit secure mounting, but stably anchors to the inner wire mesh mat 2 or clamps fast against the latter.

In order, when spraying on the outer shell 16 and the inner shell 17 made of concrete, to improve the adhesion to the top and bottom surfaces 9, 9' of the insulating body 8, 8' facing towards the wire mesh mats 1, 2 and to prevent the material from running down undesirably during processing, the top and bottom surfaces 9, 9' of the insulating body 8, 8' can be roughened. As shown in Fig. 18, the top and bottom surfaces can be provided with recesses 23 which are formed in the top and bottom surfaces 9, 9' of the insulating body 8, 8' during manufacture of

the structural member for example by means of gears or rollers which carry barbs or knobs on their circumference.

Within the scope of the invention, according to Fig. 19 it is possible to provide the insulating body 8, 8' on its top and bottom surfaces 9, 9' with transverse grooves 24 which extend in a horizontal direction if the structural member is used as a wall element. The recesses 23 and the transverse grooves 24 can be produced already during manufacture of the insulating body within the scope of the invention.

To improve the adhesion of the outer concrete shell 16 to the insulating body 8, 8', as shown in Fig. 20 a plaster base mesh 25 can be used, which rests on the top or bottom surface 9, 9' of the insulating body 8, 8' and is fixed by the web wires 7 or the insulating body 8, 8'. The plaster base mesh 25 consists for example of a fine-mesh welded or woven wire mesh with a mesh size of for example 10 to 25 mm and wire diameters within the range from 0.8 to 1 mm. The plaster base mesh 25 can within the scope of the invention also be made of expanded metal. Between the plaster base mesh 25 and the top or bottom surface 9, 9' of the insulating body 8, 8' can be arranged an additional separating layer 26 made of for example impregnated building paper or cardboard, which simultaneously serves as a vapour barrier and is preferably connected to the plaster base mesh 25.

In Fig. 21 is shown another embodiment of a structural member according to the invention, wherein in the structural member are arranged two separating layers 26 with a selectable distance from the respectively adjacent wire mesh mat 1 or 2 and in such a way with a selectable distance between each other that a gap 27 is formed between the separating layers 26. The separating layers 26 can be made for example of cardboard, plastic sheets, thin plasterboard panels or concrete slabs with or without reinforcement. The separating layers 26 are fixed in their position relative to the wire mesh mats 1, 2 either by the

web wires 7 or by means of spacers. The gap 27 between the separating layers 26 is filled with suitable insulating material either during manufacture of the structural member or only at the point of use of the structural member, as a result of which a central insulating layer 8" is formed in the structural member. As the separating layers 26 precisely fix the boundary surfaces of the central insulating layer 8", it is possible to use materials which do not have to be dimensionally stable or self-supporting to construct the insulating layer. The materials should however be pourable or flowable and can for example be made of in-situ foamable plastics, plastic, rubber or wood waste, foam chips, sand, slag, expanded concrete, rice or straw waste or brick pieces. On the surfaces of the separating layers 26 facing towards the wire mesh mats 1 or 2 can moreover be arranged in each case a plaster base mesh 25.

It goes without saying that the practical examples described may be modified variously within the scope of the general concept of the invention; in particular it is possible to apply the outer shell 16 and/or the inner shell 17 or the lining panel 21 to the structural member already at the manufacturer's works. The insulating body 8, 8' and the central insulating layer 8" as well as the separating layers 26 can be made of non-flammable materials or materials which are not readily flammable or be impregnated or provided with substances which make the insulating body 8, 8', the central insulating layer 8" and the separating layers 26 non-flammable or not readily flammable. The insulating body 8, 8' and the separating layers 26 can moreover be provided with a coat of paint which is non-flammable or not readily flammable.

Within the scope of the invention it is furthermore possible for the insulating body 8, 8' or the central insulating layer 8" to protrude laterally beyond at least one wire mesh mat 1, 2 on at least one side surface 14 of the insulating body 8, 8' or the central insulating layer 8".



Patent claims

1. Structural member consisting of two parallel welded wire mesh mats which are kept at a predetermined distance from each other by straight web wires connected to the two wire mesh mats, and an insulating body which is arranged with its top and bottom surfaces parallel to the wire mesh mats and at a predetermined distance therefrom and through which pass the web wires, characterised in that at least one straight through-hole (10, 11, 11') is formed in the insulating body (8) between the top and bottom surfaces (9, 9').

2. Structural member according to claim 1, characterised in that the or at least one through-hole (10) extends perpendicularly to the top and bottom surfaces (9, 9') of the insulating body (8).

3. Structural member according to claim 1, characterised in that the or at least one through-hole (11, 11') extends at a predetermined angle obliquely to the top and bottom surfaces (9, 9') of the insulating body (8), wherein the through-hole (11, 11') extends, when the structural member is used as a vertical wall element, obliquely downwards.

4. Structural member according to claim 3, characterised in that each oblique through-hole (11, 11') extends parallel to the longitudinal wires (3, 4) and/or parallel to the cross wires (5, 6) of the wire mesh mats (1, 2).

5. Structural member according to any of claims 1 to 4, characterised in that the insulating body (8) comprises two to six through-holes (10, 11, 11') per m².

6. Structural member according to any of claims 1 to 5, characterised in that each through-hole (10, 11, 11') has a round cross-section with a diameter within the range from



50 to 100 mm.

7. Structural member according to any of claims 1 to 6, characterised in that the distribution of the through-holes (10, 11, 11') in the structural member is random.

8. Structural member according to any of claims 1 to 7, characterised in that at least one of the wire mesh mats (1, 2) is constructed as a mesh reinforcing mat having a minimum strength of weld junctions that meets the static requirements of the structural member, corresponding mechanical strength of the mesh mat wires (3, 3', 4, 4', 5, 5', 6, 6') and also corresponding diameters and distances between the mesh mat wires (3, 3', 4, 4', 5, 5', 6, 6'), in that the web wires (7, 7') are arranged in predetermined directions relative to the wire mesh mats (1, 2), and in that the insulating body (8, 8'; 26, 8'') is kept at a predetermined distance from each of the wire mesh mats (1, 2).

9. Structural member according to any of claims 1 to 8, characterised in that the web wires (7, 7') are arranged alternately in opposite directions obliquely like a trellis, between the wires (3, 3', 4, 4', 5, 5', 6, 6') of the wire mesh mats (1, 2).

10. Structural member according to claim 9, characterised in that the web wires (7, 7') are arranged between the wires (3, 3', 4, 4', 5, 5', 6, 6') of the wire mesh mats (1, 2) in rows with web wires inclined in opposite directions within the latter, wherein the direction alternates from row to row.

11. Structural member according to claim 9, characterised in that the web wires (7, 7') extend perpendicularly to the wire mesh mats (1, 2) and in that the insulating body (8, 8') in addition can be fixed in its position relative to



the wire mesh mats (1, 2) by several spacers (12) supported on the wires (3, 3', 4, 4', 5, 5', 6, 6') of the wire mesh mats (1, 2).

12. Structural member according to any of claims 1 to 11, characterised in that the mesh body formed from the wire mesh mats (1, 2) and the web wires (7, 7') is strengthened at at least two opposite edges by edge web wires (13) which preferably extend perpendicularly to the wire mesh mats (1, 2) and are welded to the mesh mat edge wires (3', 4', 5', 6').

13. Structural member according to claim 12, characterised in that the web wires (7, 7') and the edge web wires (13) end flush with the corresponding mesh mat wires (3, 3', 4, 4', 5, 5', 6, 6').

14. Structural member according to any of claims 1 to 13, characterised in that the mesh mat wires (3, 3', 4, 4', 5, 5', 6, 6') at the end of the wire mesh mats (1, 2) end flush with the respective mesh mat edge wires (3', 4', 5', 6').

15. Structural member according to any of claims 1 to 14, characterised in that at least the web wires (7, 7') and/or the edge web wires (13) are provided with an anti-corrosion layer.

16. Structural member according to claim 15, characterised in that the anti-corrosion layer consists of a zinc layer and/or a plastic layer.

17. Structural member according to any of claims 1 to 16, characterised in that the mesh mat wires (3, 3', 5, 5') of at least the outer wire mesh mat (1) are provided with an anti-corrosion layer.



18. Structural member according to claim 17, characterised in that the mesh mat wires (3, 3', 5, 5') are copper-plated or galvanised.

19. Structural member according to any of claims 1 to 18, characterised in that at least the outer wire mesh mat (1) as well as the adjoining regions of the web wires (7, 7') and edge web wires (13) protruding from the insulating body (8, 8') are provided jointly with an anti-corrosion layer.

20. Structural member according to claim 19, characterised in that the anti-corrosion layer is applied by dip coating.

21. Structural member according to any of claims 1 to 14, characterised in that at least the web wires (7, 7') and the edge web wires (13) of the structural member are made of non-corroding materials which can be welded to the mesh mat wires (3, 3', 4, 4', 5, 5', 6, 6').

22. Structural member according to claim 21, characterised in that the web wires (7, 7') and the edge web wires (13) are made of a stainless steel grade.

23. Structural member according to any of claims 1 to 14, characterised in that the mesh mat wires (3, 3', 5, 5') of at least the outer wire mesh mat (1) are made of non-corroding materials which can be welded to the web wires (7, 7') and the edge web wires (13).

24. Structural member according to any of claims 1 to 23, characterised in that both wire mesh mats (1, 2) are constructed as mesh reinforcing mats, in that the web wires (7, 7') are constructed as shear reinforcing elements and are welded to the mesh mat wires (3, 3', 5, 5' or 4, 4', 6, 6') of at least one of the wire mesh mats (1; 2) with a predetermined minimum weld junction strength.



25. Structural member according to any of claims 1 to 24, characterised in that the mesh mat wires (3, 3', 4, 4', 5, 5', 6, 6') form square holes whose side lengths are preferably within the range from 50 to 100 mm.

26. Structural member according to any of claims 1 to 25, characterised in that the mesh mat wires (3, 3', 4, 4', 5, 5', 6, 6') form rectangular holes with short side lengths of preferably 50 mm and long side lengths of preferably 75 to 100 mm.

27. Structural member according to any of claims 1 to 26, characterised in that the distances between the web wires (7, 7') in the direction of the mesh mat longitudinal wires (3, 3', 4, 4') and of the mesh mat cross wires (5, 5', 6, 6') are a multiple of the mesh division, wherein the number of web wires (7, 7') is preferably 50 to 200 per m².

28. Structural member according to any of claims 1 to 27, characterised in that the diameters of the mesh mat wires (3, 3', 4, 4', 5, 5', 6, 6') are within the range from 2 to 6 mm.

29. Structural member according to any of claims 12 to 28, characterised in that the diameters of the web wires (7, 7') and of the edge web wires (13) are within the range from 3 to 7 mm.

30. Structural member according to any of claims 12 to 29, characterised in that the diameter of the edge web wires (13) is equal to the diameter of the web wires (7, 7').

31. Structural member according to any of claims 1 to 30, characterised in that the diameter of the web wires (7, 7') is larger than the diameter of the mesh wires (3, 3', 4, 4', 5, 5', 6, 6').



32. Structural member according to any of claims 1 to 31, characterised in that the insulating body (8, 8') is made of a dimensionally stable material.

33. Structural member according to any of claims 1 to 32, characterised in that the insulating body (8, 8') contains several cavities (15).

34. Structural member according to any of claims 1 to 33, characterised in that the insulating body (8') consists of several parts connected to each other.

35. Structural member according to claim 34, characterised in that the parts of the insulating body (8') enclose cavities (15).

36. Structural member according to any of claims 1 to 35, characterised in that the insulating body (8, 8') is made of a sound and heat-insulating material.

37. Structural member according to any of claims 1 to 36, characterised in that the insulating body (8, 8') is provided with a coat of paint which is non-flammable or at least not readily flammable.

38. Structural member according to any of claims 1 to 36, characterised in that the insulating body (8, 8') is made of foam plastics, preferably polystyrene or polyurethane foam, rubber-based foams, lightweight concrete, preferably autoclaved or porous concrete, porous plastics, rubber-based porous materials, compressed slag, compressed sludge, plasterboard panels, cement-bonded compressed boards which are made from wood chips, jute, hemp or sisal fibres, rice husks, straw waste, sugar cane waste, or mineral or glass wool, corrugated cardboard, compressed waste paper, bonded brick pieces, melted recyclable plastic waste, or rushes or bamboo canes tied together.



39. Structural member according to any of claims 1 to 36, characterised in that the insulating body (8, 8') is made of bioplastic, preferably algal foam.

40. Structural member according to any of claims 1 to 39, characterised in that at least one of the top and bottom surfaces (9; 9') of the insulating body (8, 8') facing towards the wire mesh mats (1, 2) is roughened.

41. Structural member according to claim 40, characterised in that several recesses (23, 24) are formed in at least one of the top and bottom surfaces (9; 9') of the insulating body (8, 8').

42. Structural member according to claim 41, characterised in that several transverse grooves (24) extending horizontally in the fitted state of the structural member are formed in at least one of the top and bottom surfaces (9; 9') of the insulating body (8, 8').

43. Structural member according to any of claims 1 to 42, characterised in that at least one of the top and bottom surfaces (9; 9') of the insulating body (8, 8') is provided with a layer serving as a vapour barrier.

44. Structural member according to any of claims 1 to 43, characterised in that at least one of the top and bottom surfaces (9; 9') of the insulating body (8, 8') is provided with a plaster base mesh (25).

45. Structural member according to claim 44, characterised in that between the plaster base mesh (25) and the top or bottom surface (9; 9') of the insulating body (8, 8') is provided a separating layer (26) which preferably serves as a vapour barrier and is connected to the plaster base mesh (25).



46. Structural member according to any of claims 11 to 31, characterised in that two separating layers (26) arranged at a predetermined distance from the wire mesh mats (1, 2) and fixed by the web wires (8, 8') and/or the spacers (12) and enclosing a gap (27) with a predetermined width, are provided.

47. Structural member according to claim 45 or 46, characterised in that the separating layers (26) are provided with impregnation which is non-flammable or at least not readily flammable or with a non-flammable coat of paint.

48. Structural member according to claim 46 or 47, characterised in that the separating layers (26) are made of cardboard, plastic sheets, plasterboard panels or thin concrete slabs with or without reinforcement.

49. Structural member according to any of claims 46 to 48, characterised in that the gap (27) can be filled with pourable or flowable materials which are preferably sound and heat-insulating, to form a central insulating layer (8").

50. Structural member according to claim 49, characterised in that the insulating body (8, 8') and the central insulating layer (8") are made of materials which are non-flammable or at least not readily flammable.

51. Structural member according to claim 49, characterised in that the insulating body (8, 8') and the central insulating layer (8") are made non-flammable or at least not readily flammable by impregnation and/or additives.

52. Structural member according to any of claims 49 to 51, characterised in that the central insulating layer (8") is made of in-situ foamable plastics, plastic, rubber or wood



waste, foam chips, sand, slag, expanded concrete, rice or straw waste or brick pieces.

53. Structural member according to any of claims 1 to 52, characterised in that the thickness of the insulating body (8, 8') and of the central insulating layer (8'') is within the range from 20 to 200 mm.

54. Structural member according to any of claims 1 to 53, characterised in that the insulating body (8, 8') and the central insulating layer (8'') are arranged centrally to the two wire mesh mats (1, 2), wherein the distance from each wire mesh mat (1, 2) is preferably 10 to 30 mm.

55. Structural member according to any of claims 1 to 53, characterised in that the distance between the insulating body (8, 8') or the separating layer (26) adjacent to one wire mesh mat (1) and this one wire mesh mat (1) is greater than the distance between the insulating body (8, 8') or the separating layer (26) adjacent to the other wire mesh mat (2) and this other wire mesh mat (2).

56. Structural member according to any of claims 1 to 55, characterised in that the diameters of the mesh wires (4, 4', 6, 6') of the wire mesh mat (2) located further away relative to the insulating body (8, 8') or to the central insulating layer (8''), and of the web wires (7, 7'), are larger than the diameters of the mesh wires (3, 3', 5, 5') of the wire mesh mat (1) located closer relative to the insulating body (8, 8') or to the central insulating layer (8'').

57. Structural member according to any of claims 46 to 56, characterised in that on the surface of the separating layers (26) facing towards the wire mesh mats (1, 2) is arranged in each case a plaster base mesh (25).



58. Structural member according to any of claims 1 to 57, characterised in that at least one wire mesh mat (1, 2) protrudes laterally beyond the insulating body (8, 8') or the central insulating layer (8'') on at least one side surface (14) of the insulating body (8, 8') or of the central insulating layer (8'').

59. Structural member according to any of claims 1 to 57, characterised in that the insulating body (8, 8') or the central insulating layer (8'') protrudes laterally beyond at least one wire mesh mat (1, 2) on at least one side surface (14) of the insulating body (8, 8') or of the central insulating layer (8'').

60. Structural member according to any of claims 1 to 59, characterised in that the wires (3, 3', 4, 4', 5, 5', 6, 6') of one or both wire mesh mats (1, 2) comprise a ribbed surface.

61. Method for sheathing a structural member according to any of claims 1 to 60, characterised in that to the outer wire mesh mat (1), which is designed to form the outside of the structural member, is applied a concrete outer shell (16, 16') which adjoins the insulating body (8, 8') or the separating layer (26) adjacent to the outer wire mesh mat (1), surrounds the outer wire mesh mat (1) and together with the latter forms the load-bearing part of the structural member, in that to the inner wire mesh mat (2), which is designed to form the inside of the structural member, is applied a concrete inner shell (17, 17') which adjoins the insulating body (8, 8') or the separating layer (26) adjacent to the inner wire mesh mat (2), surrounds the inner wire mesh mat (2) and together with the latter forms the load-bearing part of the structural member, and in that at the same time each through-hole (10, 11, 11') is filled with a concrete web (18, 18') which connects the concrete outer shell (16, 16') and the concrete inner shell (17,



17') in force-locking relationship.

62. Structural member manufactured by the method according to claim 61, characterised in that the inner shell (17, 17') is made of concrete, plaster or mortar.

63. Structural member according to claim 62, characterised in that the outer shell (16') is provided with an additional reinforcing mat (19) whose distance from the outer wire mesh mat (1) can be selected according to the static requirements of the structural member.

64. Structural member according to either of claims 62 or 63, characterised in that the inner shell (17') is provided with an inner additional reinforcing mat (19') whose distance from the inner wire mesh mat (2) can be selected according to the static requirements of the structural member.

65. Structural member according to any of claims 62 to 64, characterised in that the diameters of the longitudinal and cross wires of the outer and/or inner additional reinforcing mat (19 or 19') are larger than the diameters of the mesh mat wires (3, 3', 4, 4', 5, 5' 6, 6').

66. Structural member according to any of claims 62 to 65, characterised in that the inner additional reinforcing mat (19') is connected to the inner wire mesh mat (2) and/or the outer additional reinforcing mat (19) is connected to the outer wire mesh mat (1) each by several distance wires (24), wherein the distance wires (20) are arranged at a selectable distance from each other and preferably extend perpendicularly to the wire mesh mats (1, 2) and the additional reinforcing mats (19, 19'), wherein their diameters are preferably equal to the diameters of the mesh mat wires (3, 3', 4, 4', 5, 5' 6, 6').



67. Structural member according to any of claims 61 to 66, characterised in that the thickness of the outer shell (16, 16') and/or of the inner shell (17, 17') is within the range from 20 to 200 mm.

68. Structural member according to any of claims 1 to 67, characterised in that the inner wire mesh mat (2) forms the load-bearing part for a lining panel (21) which forms the non-load-bearing inner wall of the structural member.

69. Structural member according to claim 68, characterised in that the lining panel (21) can be anchored to the inner wire mesh mat (2) by an assembly aid (22) arranged between the insulating body (8, 8') or the separating layer (26) adjacent to the inner wire mesh mat (2) and the inner wire mesh mat (2).

70. Structural member according to claim 69, characterised in that the assembly aid (22) extends between the web wires (7, 7') and can be attached to the wires (4, 4', 6, 6') of the inner wire mesh mat (2).

71. Structural member according to either of claims 69 or 70, characterised in that the lining panel (21) is made of lightweight building material, preferably wood or plasterboard.