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(54) BUILDING BLOCK AND METHOD FOR PRODUCING THE SAME

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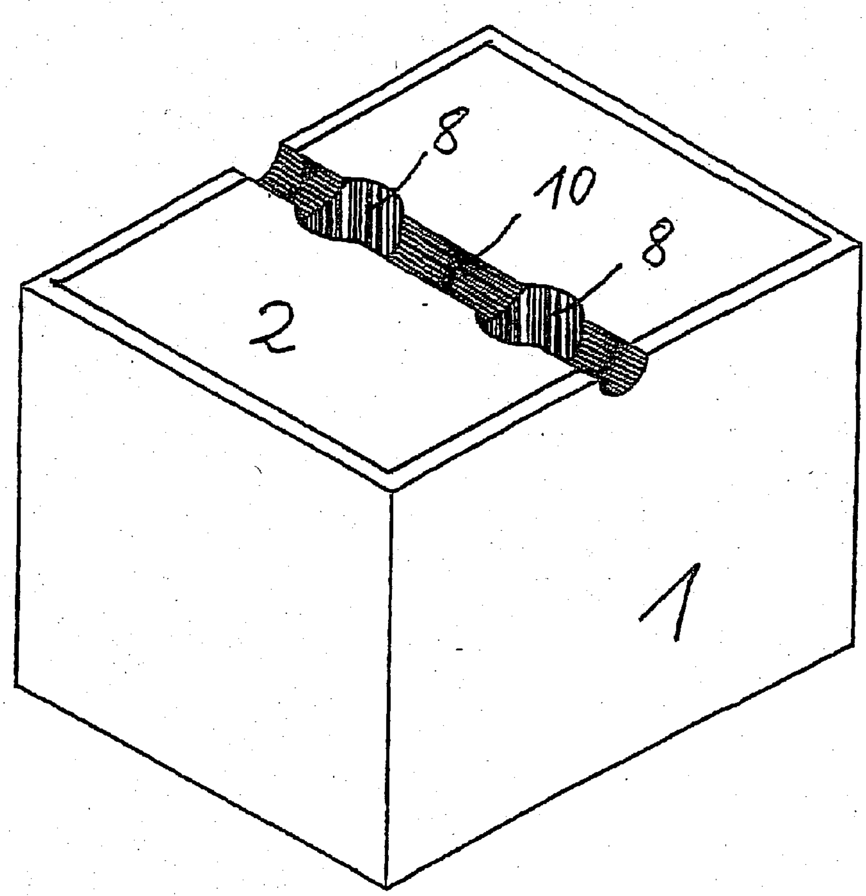
(57) **ABSTRACT**

The invention relates to a building block and a method for producing the same, which has a reduced mass by comparison with conventional building blocks and excellent insulating properties. The building block according to the invention consists of a lightweight material which is selected from expanded glass, pearlite, expanded clay or mixtures thereof. The lightweight material is obtained by liquid phase sintering or fusing of pre-expanded glass granulate, clay granulate, pearlite or mixtures thereof and forms a pore structure as an insulating core which is at least partially enclosed by a shell body formed from a conventional building block material. The building block is produced by an appropriate shell body being filled with the lightweight material, and the pre-expanded lightweight material, which has a residual expanding agent content of at least 0.1 mass % and is used in granulate form, being heated to above the softening temperature of the granulate, an additional volume expansion occurring and the granulate surfaces being fused.



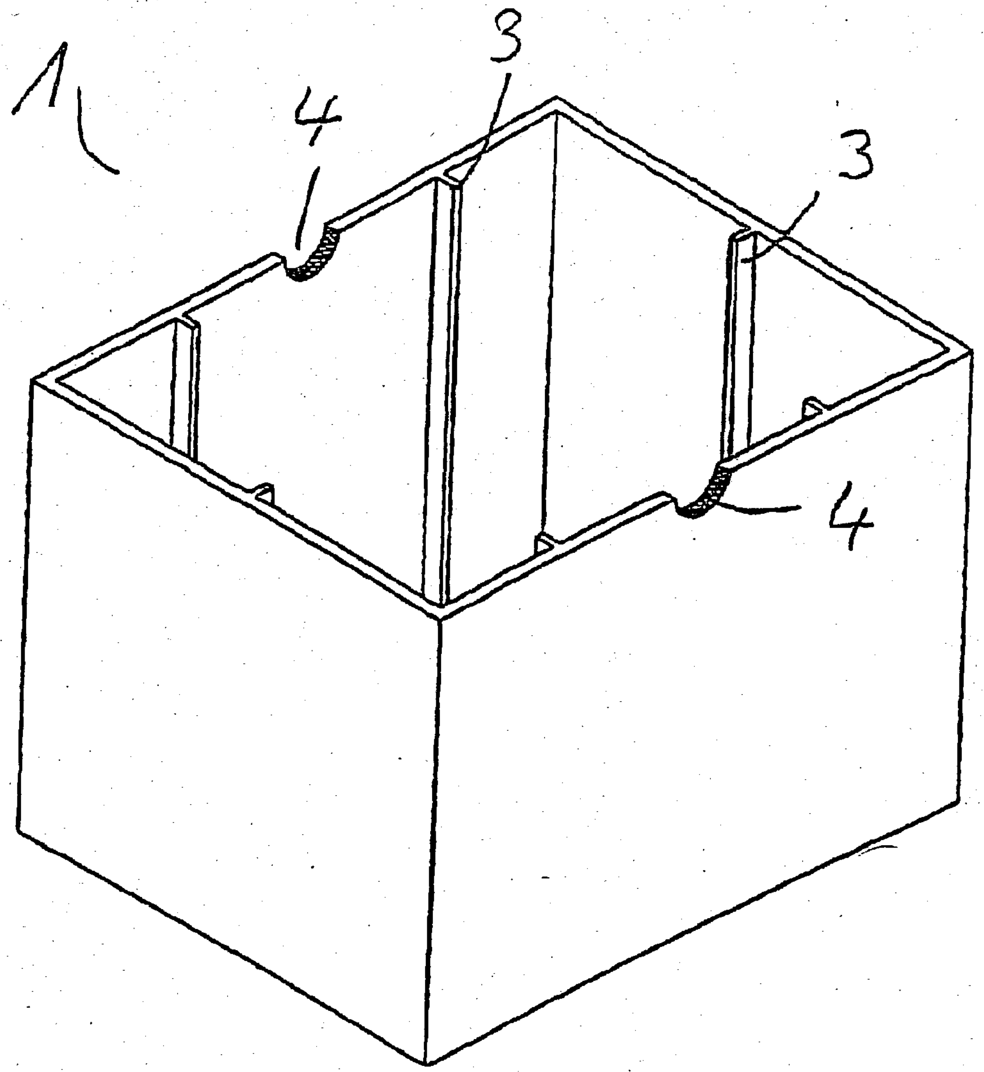


Fig. 1

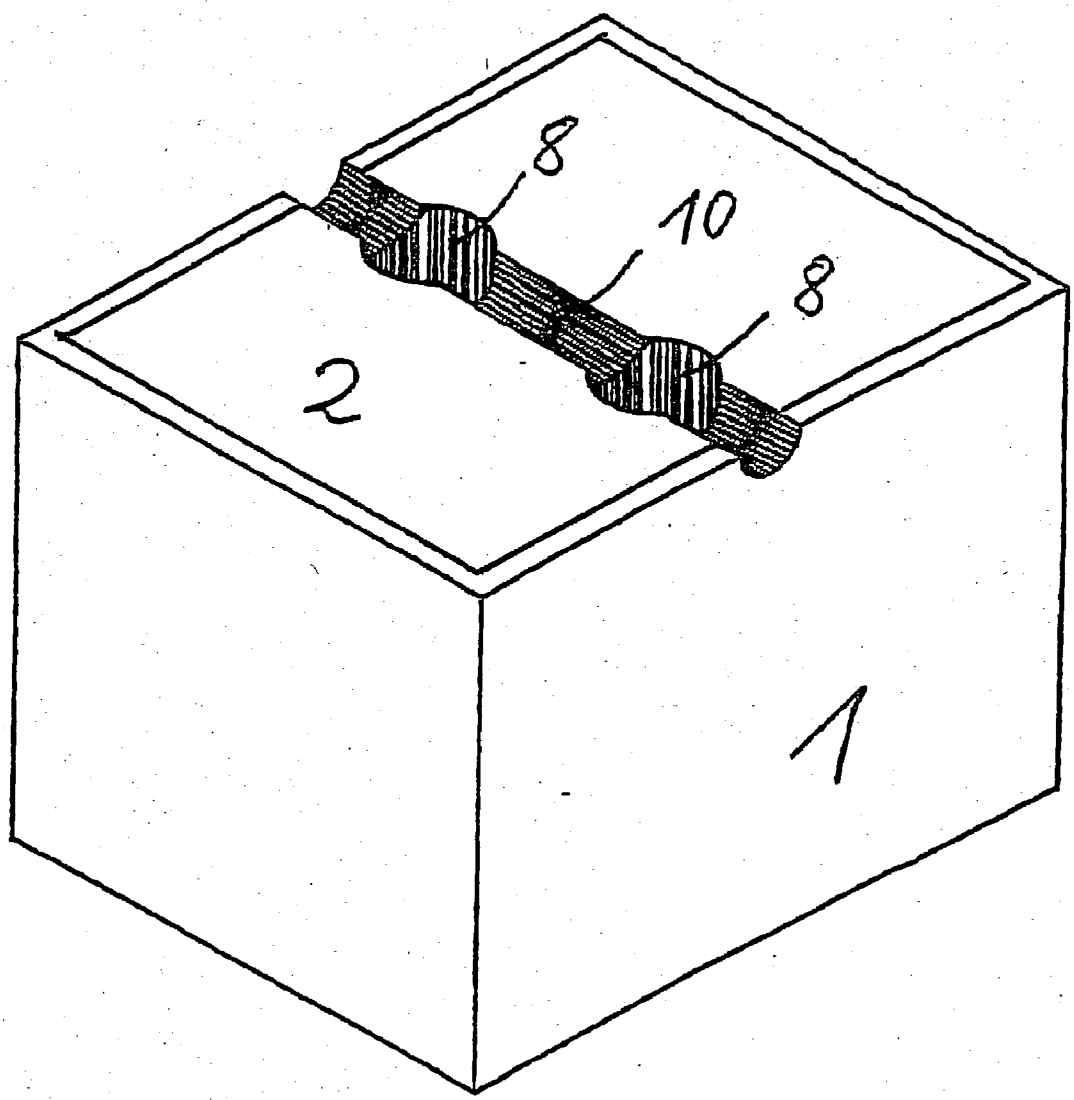


Fig. 2

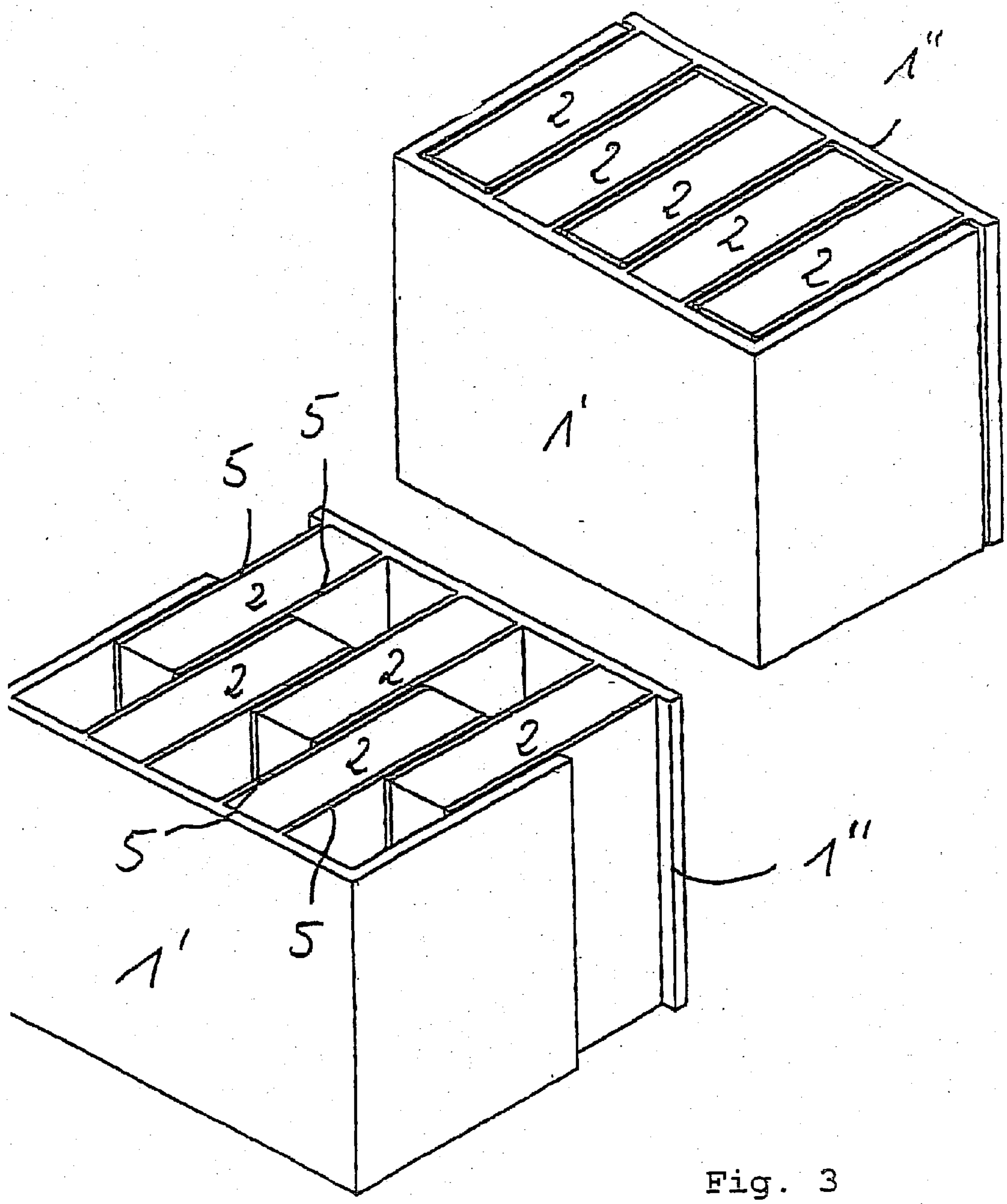


Fig. 3

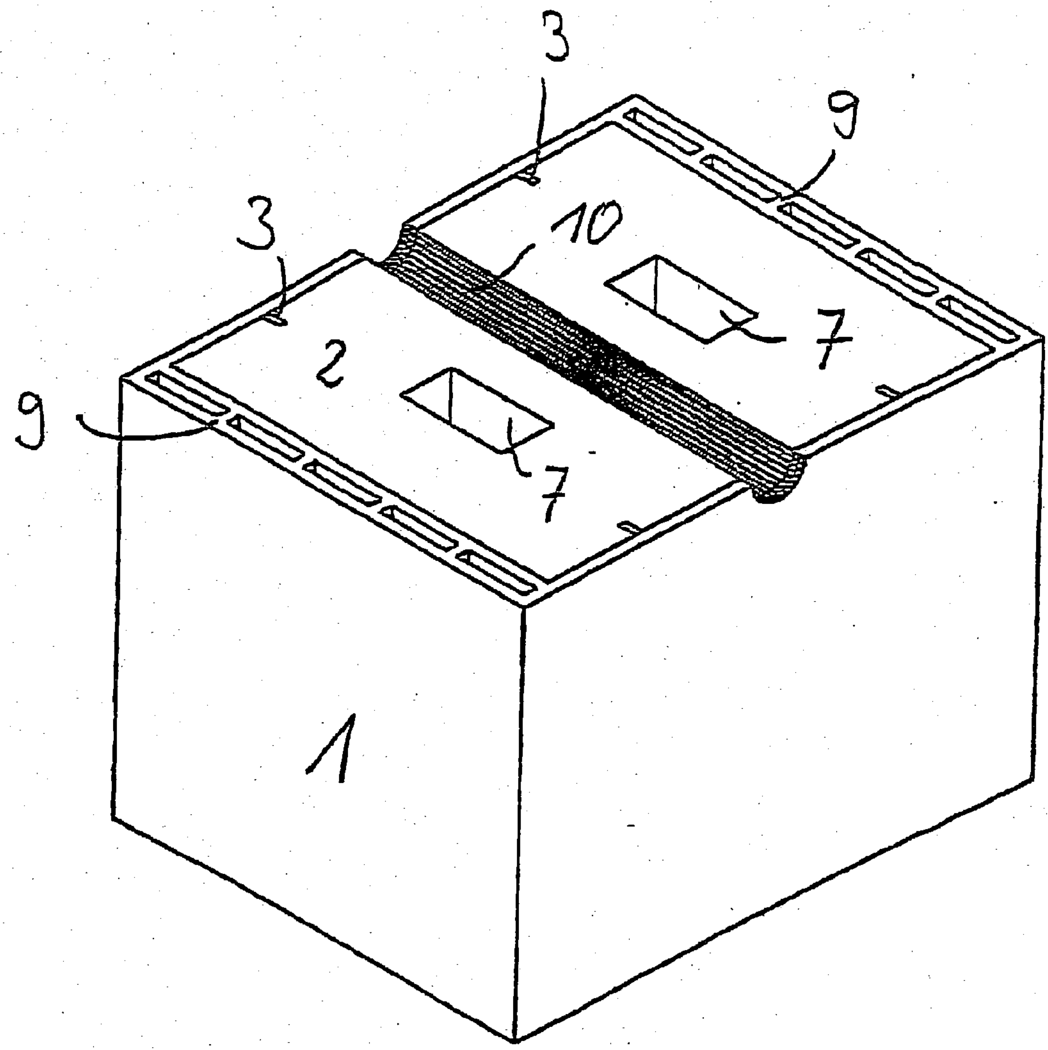


Fig. 4

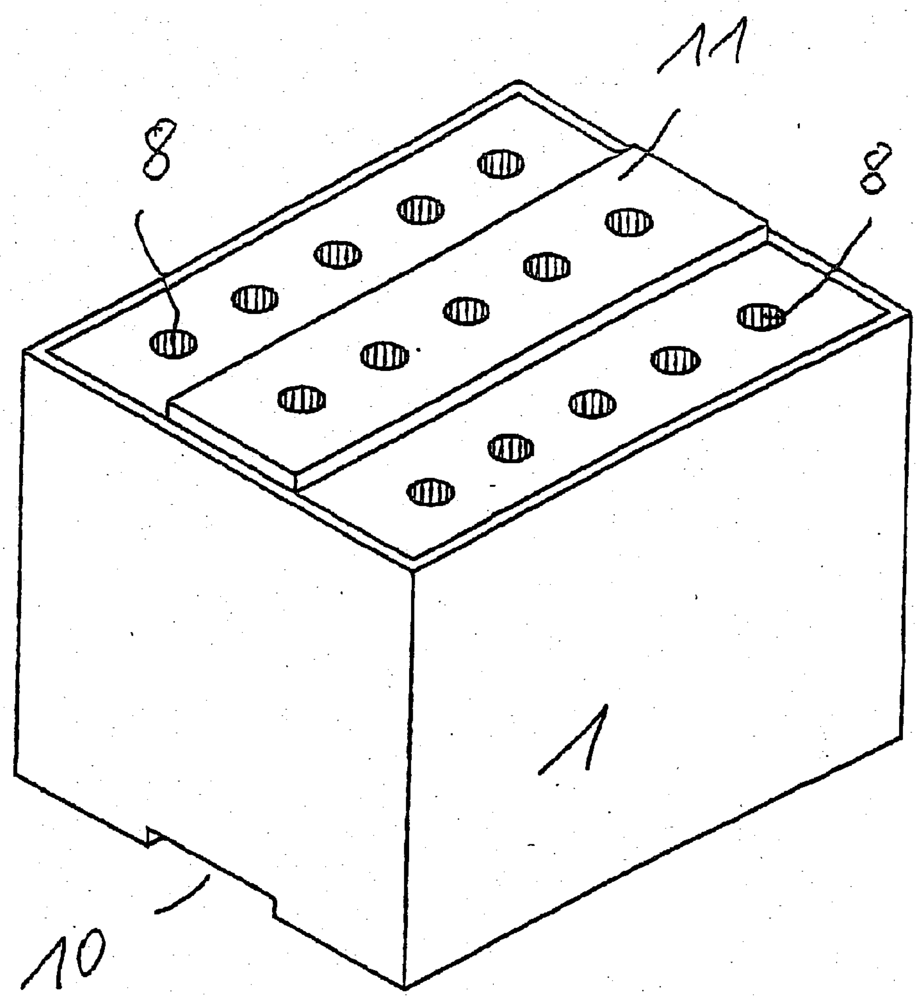


Fig. 5

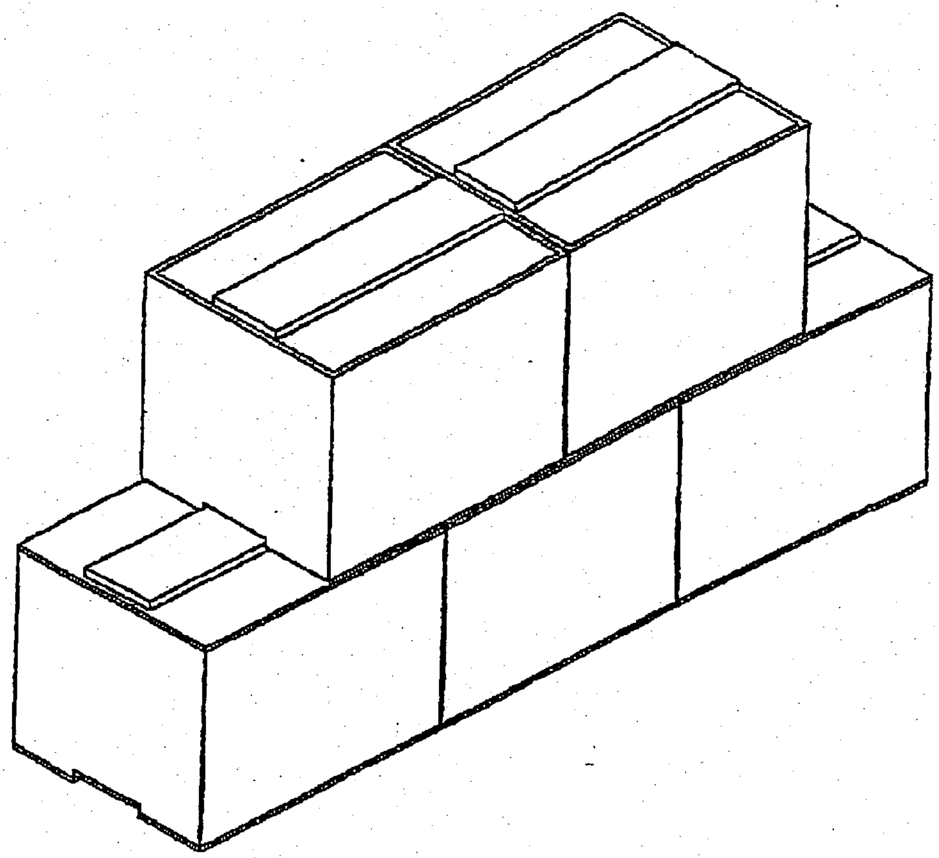


Fig. 6

Reapor brick

with tongue-and-groove system, example of brickwork

BUILDING BLOCK AND METHOD FOR PRODUCING THE SAME

[0001] The invention relates to a building block and to methods for producing the same, such building blocks being able to be also used easily, like conventional building blocks, in the building of detached houses and multi-occupancy dwellings and in dry-stack building, and being able to have excellent insulating properties.

[0002] Building blocks or bricks have proved for a relatively long time to be technically and economically valuable in the building sector as brickwork, ceiling slabs or hollow bricks. In the course of the years, these building elements used have been continuously improved taking into account the raised requirements of the market. These improvements related in particular to the insulating properties and substantially to heat insulation. Thus the developments led to porous lightweight bricks with filigree hole patterns to which however limits are set in particular for strength reasons. Thus minimum bulk densities and web thicknesses have to be kept to in order to guarantee on the one hand sufficient strength and security during transport and processing, and to avoid any undesired destruction occurring before processing and nevertheless sufficient static properties being able to be achieved.

[0003] If such filigree blocks with low web thicknesses are used, this also impairs the sound insulation and longitudinal acoustic insulation in an undesired manner.

[0004] Lightweight concrete blocks or aerated concrete also have their limits since the desired heat insulation properties and the necessary strength are contrary to one another and consequently the corresponding advantages and disadvantages have to be balanced against one another and must lead to a corresponding compromise.

[0005] From the viewpoint of heat and sound insulation, admittedly a larger wall thickness could theoretically be selected, which however leads in each case to area losses.

[0006] To provide the necessary heat insulation, it is usual to use organic or inorganic heat-insulating composite systems, lying on the outside of such built walls or ceilings which however lead in turn to an increase in thickness and to increased time and cost outlay. Such double-shelled wall structures, which are formed from a support layer with an insulating layer glued on and/or mechanically secured thereto, with an additional exterior rendering, can admittedly be easily used in the renovation of old buildings, in which the above-mentioned disadvantages can be accepted, but for new buildings, in which no allowance has to be made for old building substance, this is however only a compromise burdened with disadvantages.

[0007] Moreover an attempt has been made to produce expanded clay or pumice hollow blocks in which an integrated insulation is present without any additional increase in thickness. For such integrated insulation, various organic materials were used. The integration of such organic insulating materials, presented very great difficulties, however, thus also attempts of the brick industry failed in which albuminous foam was intended to be processed with brick dust to form a brick foam, since during the foaming process, especially in the case of larger component thicknesses, great inherent tension was induced which caused corresponding losses of strength.

[0008] The object of the invention, therefore, is to propose a building block and corresponding manufacturing methods, with which building blocks can be made available in a cost-effective manner, which with relatively low density have high strength, good sound insulation and thermal insulation behaviour and are easy to process.

[0009] According to the invention, this object is accomplished with the features of claim 1 for a building block and the features of claims 14 to 25 for corresponding manufacturing methods.

[0010] A building block according to the invention consists essentially of two parts, and this can be on the one hand a shell body, which comprises a statically load-bearing material, such as for example conventional brick or tile material, burnt clay or loam, lightweight concrete formed from expanded clay, pumice or similar lightweight aggregates, aerated concrete or wood-concrete. The second essential part of such a building block is an insulating core which is surrounded by the shell body and has been formed by liquid phase sintering from expanded glass, pearlite, expanded clay or mixtures thereof or by fusing pre-expanded glass granulate, expanded clay granulate, pearlite or mixtures, having a cellular structure.

[0011] The shell body should at least at its upper end face be partially or completely open so that the initially mentioned materials or the corresponding pre-foamed granulates can be filled into the shell body, or a prefabricated insulating core can be pressed into the shell core. The insulating core is consequently surrounded at least partially by the shell core, at least on four sides however.

[0012] For a secure hold of the moulded-in or pressed-in insulating core, inside the shell core webs and/or grooves can be formed which hold the insulating core as a form-fit.

[0013] In the configuration of the insulating core, two alternative suitable ways can be taken; firstly it is possible so to proceed that a pre-expanded granulate as a lightweight material, which is selected from expanded glass, expanded clay, pearlite or mixtures thereof, is filled, together with a residual amount of expanding agents of at least 0.1 mass %, either directly into the shell body or into a mould, then heating up to temperatures above the softening temperature of the granulate is undertaken, which leads to an additional volume expansion and to fusing of the granulate surfaces. During this process, the insulating core is directly formed in the shell body, or after the process of being released from the mould it can be pressed into the open portion of the shell body and possibly, fixed using the already mentioned, possibly relatively short, webs which are preferably arranged at the respective end face regions, i.e. at the top and at the bottom inside the shell body.

[0014] In the second alternative, a mixture which consists of 60 to 95 mass % of a lightweight aggregate, selected from expanded glass, pearlite and expanded clay, and possibly also mixtures thereof, mixed with 40 to 45 mass % of a soda water-glass can be filled into a shell body or a mould, and thereafter during heating, forming soda-lime glass by liquid phase sintering, the lightweight aggregate particles are connected in network fashion and thus the insulating core can be formed. If the insulating core is produced in a mould, this can, as already described previously, be pressed, after being released from the mould, into the shell body which is open at least at the upper end face and held there.

[0015] Before heating, the mixture can possibly be dried at temperatures in the range between 50 and 95° C. The sintering then takes place in the temperature range between 550° C. and 1000° C., this taking place in a period between 0.1 and 5 h, preferably in the range between 0.1 and 0.5 h.

[0016] Moreover, a corresponding method for producing moulded articles from lightweight aggregates is described in detail in DE 197 12 835 A1, and extensive reference should be made to the appropriate disclosed content.

[0017] In the case of the first mentioned alternative for producing a building block according to the invention using pre-expanded glass granulate, expanded clay granulate, pearlite or mixtures thereof, with which an aerated structure can be obtained as the insulating core, a more detailed description will now follow.

[0018] The insulating core present in a building block according to the invention can consist exclusively of pre-expanded glass, expanded clay or pearlite, without the usual binding or sintering aids being also contained. It can be formed from the respective granulate which is fused together and thus a relatively lightweight building block can be obtained with a relatively small bulk density but higher strength. The insulating core can have a closed-pore structure or respectively such a structure. It can have a bulk density which is $\leqq 250$ kg/m^3 down to bulk densities in the region of 180 kg/m^3, with compressive strengths of approx. 1.6 N/mm^2, bending strengths of approx. 0.9 N/mm^2 and tensile strengths of approx. 0.2 N/mm^2.

[0019] The insulating core has low heat conductivity, is non-combustible, resistant to acid and bases, dimensionally stable, resistant to biological exploitation (rodents, beetles, mould and the like) and can be safely recycled. It absorbs practically no moisture and can consequently be used in the building material sector in many cases more advantageously than is possible with conventional building materials and structural elements.

[0020] The process in the production of the building block according to the invention can be such that by preference pre-expanded glass, but also pearlite or thermally pre-expanded, clay can be used as a granulate, and in each case a residual content of expanding agent of at least 0.1 mass % to 3 mass % can be contained.

[0021] The granulate thus prepared is placed in a mould comprising at least two parts or in a shell body formed from a material usually used for building blocks or tiles and then heated in the mould or the shell body. The heating takes place here in a temperature range in which the respective granulate softens i.e. reaches the corresponding softening temperature and is held. As a result of the heating, further volume expansion of the initial granulate occurs and the granulate surfaces fuse with one another, such that the finished insulating core is available, possibly after being released from the mould, or it is formed inside the shell body.

[0022] Since the pre-expanded initial granulate experiences a further volume increase as a result of the heating, it is advantageous to fill the mould or the shell body with the initial granulate only to a volume proportion of at least 80% and at maximum 95%, preferably at least 85% by volume. Thus during the heating, a closed-pore structure can be obtained which completely fills the preferably at least two-part mould or the shell body and the desired properties are obtained.

[0023] After the mould or the shell body has been filled, during which process attention should be paid to as uniform as possible filling of the shell core or mould cavity, the pre-expanded initial granulate, which is at least 80% of the final volume, preferably at least 85% of the final volume, is heated in the mould or the shell body and further expanded.

[0024] It is advantageous to carry out the heating in two stages, different heating rates being used in the two stages. In both stages, however, the heating rate should be constant. Thus a uniform heating over the entire volume can be ensured and a uniform fine structure formed. Thus in a first heating stage a higher heating rate, e.g. 5 K/min and in the second heating stage a lower heating rate, e.g. 2 K/min should be used. The-heating in the first stage should be up to temperatures of 650° C. and in the second stage up to approx. 750° C., when pre-expanded glass has been used as the initial granulate.

[0025] After the necessary softening temperature for the granulate has been reached, the corresponding temperature is maintained over a specific period of time, such that the granulate surface is securely fused together.

[0026] Following the heating, before releasing the moulded article from the mould, or with the insulating core formed in the shell body, slow cooling should take place in order as far as possible to avoid internal stress in the finished insulating core. The necessary time for cooling to ambient temperature can here be up to 10 h. The initial granulate used should be used in a particle size range between 1 and 8 mm, preferably between 2 and 4 mm, a uniform granulation in the narrow tolerance range possibly requiring shorter heating and holding time and ensuring a uniform structure formation.

[0027] The proportion of expanding agent necessary in, the production of such an insulating core should be in the range between 0.1 and 3 mass %.

[0028] In contrast to conventionally produced moulded articles formed from foamed glass, which is produced from the usual raw materials quartz sand, calcium carbonate, potassium feldspar, iron oxide and sodium carbonate, to which merely a small proportion of old glass can be added, the moulded articles according to the invention can be produced completely from an expanded glass granulate obtained from old glass. Here shards of old glass can be ground and mixed together and after the addition of an expanding agent, e.g. sugar derivative, this powdery mixture is granulated and thereafter thermally pre-expanded, and specifically in such a way that the pre-expanded granulate has approx. 80 to 95% of the volume occurring in the finished insulating core.

[0029] In this thermal pre-expansion, the procedure can be such that the proportion of expanding agent necessary for production is already contained in the pre-expanded glass granulate. This can be achieved for example by a relatively rapid heat treatment which leads to thermal expansion.

[0030] In an equivalent manner, in the use of the already mentioned two additional initial granulates, which can also be applied in a form which is pre-expanded as far as possible, other heating rates and temperatures to be achieved arise, however, which correspond to the softening temperatures of the respective granulate.

[0031] Acoustic decoupling can also be achieved between the shell body and insulating core, which can involve various flexible materials. Thus for example the shell body can be provided with an appropriate inner coating before being filled, or before a prefabricated insulating core is pressed in, or the insulating core can be covered on the outside with an appropriate material, it being possible for example to use corrugated cardboard which can simultaneously be used as packing.

[0032] Moreover the number of cavities or hollow chambers even with relatively low heat conductivity is substantially smaller than is the case with conventional building blocks. Thus in comparison with conventional porous lightweight bricks, the thermal resistance can be increased by approx. 30% which in a future rise in heat insulation levels to be achieved according to the low-energy house standard does not lead to any further increase in thickness of a wall and correspondingly to no reduction in the usable room areas.

[0033] With the building blocks according to the invention, with a relatively small block bulk density $\leqq 600$ kg/m^3, the necessary brick strength class for detached houses and two-family houses can be easily maintained.

[0034] Independently of the initial materials used, in this heat treatment not only is a bond achieved between the lightweight aggregate particles or the granulate but there is also bonding of the insulating core to the shell body forming a glass mass.

[0035] As also already indicated, there exist a number of alternative ways of producing a building block according to the invention. Thus for example the shell body (formed from clay for example) can be filled even during the firing process with pre-heated granulate (expanded glass granulate) in the cooling phase, it being possible for the waste heat from the firing process to be exploited for the pre-heating. After filling, heating takes place again to the softening temperature of the granulate or respectively the necessary temperature for the liquid phase sintering.

[0036] For filling, a hopper formed from an austenitic steel which has an adequate high-temperature strength can be used.

[0037] In particular the expanded glass granulates which can be used have good flow behaviour such that the filling of the shell bodies can take place in the very short time of a few seconds. During filling, however, the softening temperature of the granulate should not be exceeded.

[0038] Advantageously the heating takes place in a fast-burning furnace, e.g. a rotary kiln, with a filling device in the cooling region, by a plurality of brick shell bodies standing vertically beside one another on kiln plates being able to be heat-treated.

[0039] For smaller brick-works which have discontinuous furnaces such as, for example, truck chamber kilns operated in a reciprocating manner, the brick shell bodies should, after firing, be automatically removed with a handling device from the furnace truck and be supplied to a separate filling station. After the hollow bodies have been filled with the lightweight aggregate or granulate, the shell bodies on a kiln plate can be automatically deposited again on a furnace truck and the filled furnace truck supplied to the final heating phase (annealing).

[0040] The invention will now be explained in greater detail below with the aid of examples.

[0041] The figures here show:

[0042] **FIG. 1** an example of a shell body of a building block according to the invention;

[0043] **FIG. 2 a** further example of a building block according to the invention, comprising shell body and insulating core with formed hollow chambers and reinforcement channel;

[0044] **FIG. 3 a** building block according to the invention comprising two parts, as a so-called sliding brick in two attainable sizes for linear alignment;

[0045] **FIG. 4 a** further example of a building block according to the invention;

[0046] **FIG. 5** an example of a building block according to the invention, with a tongue-and-groove connection; and

[0047] **FIG. 6 a** structure of a plurality of building blocks according to **FIG. 5**.

[0048] The insulating cores **2** can, as described in DE 197 12 835 A1, be produced in a separate mould or in the shell body **1** for a building block according to the invention. To this end, the already mentioned lightweight aggregates are coated with the sintering aid and either placed in the shell body **1** or this mass is brought by a correspondingly appropriate shaping method (e.g. axial pressing, extruding, moulding) into the desired shape and thereafter dried. This green product can be subjected to a subsequent heat treatment in which liquid phase sintering takes place, by which means the lightweight aggregate particles are connected at points to one another. During the sintering, there is an ion exchange between the liquid phase and the particles, which leads to a material bond, such that a corresponding porous structure with a small bulk density and relatively increased strength is obtained.

[0049] If the insulating core **2** is produced from pre-foamed granulates, without the addition of a binding or sintering aid, either as divisible a mould as possible or the shell body **1** is filled with the corresponding pre-foamed granulate. The filling takes place in a loose packing, and as uniform as possible a filling level should be maintained e.g. by shaking.

[0050] During the heat treatment of this loose packing, a renewed volume expansion (expanding process) occurs and the initial material foams again so that the bulk density is further reduced. The initial granulate is approx. 85% of the pore volume of the finished insulating core **2**. Thus similar to EPS production, starting from a porous initial product in granular form, during shaping a further volume increase of approx. 15% takes place.

[0051] In concrete terms, a building block according to the invention, as also shown in the figures, can be so produced in a preferred shape that a shell body **1** formed from burnt clay is filled with an expanded glass granulate which is available under the trade-name "Liaver". The expanded glass granulate has a bulk density of 220 kg/m^3 and is used with a granulation of between 2 and 4 mm. The expanded glass granulate used has an increased residual expanding agent content which should be at least 0.1 mass %.

[0052] By shaking, the loose packing in the shell body **1** should be levelled out.

[0053] A building block blank thus prepared can then be heated in a discontinuous chamber kiln or in a discontinuously operated pushed-batt kiln at a heating rate of 5 K/min to 650° C. and thereafter at a heating rate of 2 K/min to roughly 750° C., the softening temperature of the granulate, and kept at this temperature over a period of approx. 30 mins, melting or fusing of the granulate surfaces taking place and the initial material being additionally expanded, such that an additional volume increase by comparison with the loose packing can be achieved and the insulating core **2** correspondingly formed inside the shell body **1** completely fills the inner volume of the shell body **1**.

[0054] Following the heating and holding phase, cooling is carried out inside the furnace chamber over a period of approx. 10 h.

[0055] If required, the building blocks can be surface-ground, placed on pallets and made ready for despatch, the upper and lower end face of the building blocks being also able to be machined in-the shape of a tongue-and-groove connection.

[0056] The building blocks obtained in this manner have the properties listed in Table 1.

[0057] In **FIG. 1** is represented a shell body **1** without an insulating core **2**. The shell body **1** can for example be extruded from clay in the shape represented and cut to the corresponding format, the cutting width here pre-determining the height of a corresponding building block.

[0058] The shell body **1** can be produced from clay and thereafter, as already described, be fired in a furnace. After firing, filling with the initial material for the insulating core **2** and the corresponding subsequent heat treatment can be carried out.

[0059] In the example shown in **FIG. 1, a** plurality of webs **3** are formed on the inner wall of the shell body **1**, these extending here parallel to the direction of extrusion and being able, in addition to increasing the strength of the shell body **1**, also to represent secure fixing for the insulating core **2** to be formed or received.

[0060] The webs **3** can, however, also be arranged in an inclined manner, or be provided with contours, and these can then be groove-like incisions or corrugations, in order to further improve the hold of the insulating core **2**.

[0061] The shell body **1** represented here can not only, as shown, be open at its upper end face but also the lower end face can be open, the filling of the shell body **1** being then able to take place in a position placed on a base-plate on which the filled shell body **1** can then be heat-treated in a furnace.

[0062] Moreover, diametrically opposite semi-circular recesses **4** are represented, it being possible for shapes other than the semi-circular form to be used also.

[0063] These recesses **4** can be the starting point for a reinforcement channel **10**, such as has been formed in the example shown in **FIG. 2**. Through such reinforcement channels **10**, reinforcing members which extend over a plurality of building blocks disposed beside one another, can be guided and increase the hold of walls formed from a plurality of such building blocks.

[0064] Moreover in this example hollow chambers **8** are represented, which in addition to reducing mass and increasing heat insulation can also be used for anchoring reinforcing members.

[0065] Both the reinforcement channels **10** and the hollow chambers **8** can be configured using correspondingly shaped cores, which are formed for example from a metal with a higher melting temperature than the insulating core material during the heat treatment. Such cores can here be formed on a mould which can be laid onto the upper end face of the shell body **1**, this mould part which is plate-shaped per se, being able with an appropriately matched amount of filling of the lightweight aggregate also to lead to a relatively flat upper end face of a building block according to the invention, without any additional extra processing such as surface-grinding being necessary.

[0066] Represented in **FIG. 3** is a building block according to the invention, formed from two individual parts **1'** and **1"** and provided as a sliding member for adaptation to various lengths. Present on the two individual parts **1'** and **1"** are longitudinal webs **5** aligned parallel to one another which are alternately left empty and filled with an insulating core **2**, such that through the meander-shaped arrangement of the insulating cores **2**, the two parts **1'** and **1"** are pushed into one another and can be drawn apart according to the length required.

[0067] Here the smallest length of such a building block is shown in the upper diagram and a larger length in the lower diagram of **FIG. 3**.

[0068] In the example of a building block according to the invention shown in **FIG. 4**, additional grip recesses **7**, for better handling, are formed at the upper end face beside a reinforcement channel **10**, the grip recesses **7**, as in the example according to **FIG. 2**, also being able to be produced with appropriately formed moulded cores.

[0069] On the shell body **1**, diametrically opposite end faces in the form of double webs **9** are shown which can also advantageously influence the insulating behaviour and the strength. However, such double webs **9** can also be formed on the two other sides of such a shell body **1**.

[0070] If in this example and in the other described examples a prefabricated insulating core **2** is pressed into a shell body **1**, it can be advantageous and sufficient to form the webs **3** merely in the region of the upper and lower end faces and not, as, in the example of **FIG. 1**, continuously, so that the pressed-in insulating core **2** is interlocked after being pressed in.

[0071] In the example of a building block according to the invention shown in **FIG. 5**, the upper and lower end faces are configured as a tongue-and-groove connection **10,11**, such that for the construction of a wall only a little skill and expert knowledge is necessary, exact positioning of a plurality of building blocks, as shown in **FIG. 6**, being easily attainable with the tongue-and-groove connection.

[**0072**] Moreover, in the insulating core **2**, hollow chambers **8** are again formed which can extend from the upper to the lower end face of the building block.

[**0073**] The building blocks according to the invention can be cemented together with a conventional thin-bed mortar or crunched together. Moreover, there is also the possibility of producing complete masonry stacks from a plurality of such building blocks through the introduction of reinforcing members which are guided through the reinforcement channels **10** shown but also through continuous hollow chambers **8**, and of bringing these stacks to the building site as complete wall elements.

[**0074**] By means of the method according to the invention, the hollow chambers can be easily arranged in defined positions such that alignment of the hollow chambers in relation to hollow chambers in building blocks disposed above and below, forms continuous cavities inside the wall, through which also vertically aligned reinforcing members or installations (house technical fittings) can be guided.

[**0075**] The reinforcing members can be coupled to the brick composite by means of a filling mortar and thus be protected against corrosion to a very large extent. Since the reinforcing members are at least completely enclosed by insulating core material, thermal bridges can be avoided.

TABLE 1

Property profile

Property	Unit	Value
Brick bulk density	kg/m^3	<600
Compressive strength	N/mm^2	>2 N/mm^2
Equivalent heat conductivity of the masonry	W/mK	0.09
k-value of the masonry	W/m^{2}K	0.259*

*14 mm internal plaster, 20 mm insulating plaster, 300 mm building block, mortar used = LM 21

1. Building block, in which a lightweight material, which has been produced by fusing of pre-expanded glass granulate, expanded clay granulate, pearlite or mixtures thereof, with a residual content of binding agent of 0.1 to 3 mass % forms a closed-pore structure as an insulating core (2) with a bulk density ≦600 kg/m^3, is enclosed at least partially by a shell body (1) formed from a conventional building block material.

2. Building block according to claim 1,

characterised in that

the shell body (**1**) is formed from burnt loam, clay and a clay mass as well as wood-concrete, lightweight concrete formed from expanded clay, pumice or similar lightweight aggregates.

3. Building block according to claim 1 or **2**,

characterised in that the shell body (**1**) is partially or completely open at least at its upper end face.

4. Building block according to one of claims 1 to 3,

characterised in that webs (**3**) and/or grooves are formed on the inner wall of the shell body (**1**).

5. Building block according to one of claims 1 to 4,

characterised in that recesses (**4**) are formed on upper and/or lower end faces of the shell body (**1**) for reinforcing members to be led through.

6. Building block according to one of claims 1 to 5,

characterised in that the shell body (**1'**, **1"**) is configured in two parts with a plurality of longitudinal webs (**5**) aligned parallel to each other, in each case, adjacently in pairs, alternately air or an insulating core (**2**) is present between these longitudinal webs (**5**) and the one part of the shell body (**1'**) can be guided into the second part of the shell body (**1"**) by an appropriate meander-shaped arrangement of the insulating cores (**2**).

7. Building block according to one of claims 1 to 6,

characterised in that grip recesses (**7**), reinforcement channels (**10**) and/or hollow chambers (**8**) are formed in the insulating core (**2**).

8. Building block according to one of claims 1 to 7,

characterised in that double webs (**9**) are formed on the shell core (**1**).

9. Building block according to one of claims 1 to 8,

characterised in that the upper and lower end faces are configured as a tongue-and-groove connection (**11**, **12**).

10. Building block according to one of claims 1 to 9,

characterised in that acoustic decoupling is present between the inner wall of the shell core (**1**) and the insulating core (**2**).

11. Building block according to one of claims 1 to 10,

characterised in that the insulating body (**2**) has a bulk density ≦250 kg/m^3.

12. Building block according to one of claims 1 to 11,

characterised in that the insulating body (**2**) represents a closed-pore structure.

13. Building block according to one of claims 1 to 12,

characterised in that lightweight aggregate particles, selected from expanded glass, pearlite and expanded clay, are interconnected in network fashion forming a soda-lime glass.

14. Method for producing a building block according to one of claims 1 to 13, characterized in that the interior of a shell body (**1**) is filled, to at least 80% of its final volume, with thermally pre-expanded glass, thermally pre-expanded pearlite or thermally pre-expanded clay, as a granulate, with a residual expanding agent content of 0.1 to 3 mass %, and then heating is carried out up to temperatures above the softening temperature of the granulate which leads to a further volume expansion and to sintering of the granulate surfaces.

15. Method for producing a building block according to one of claims 1 to 13, characterised in that thermally pre-expanded glass, thermally pre-expanded pearlite or thermally pre-expanded clay with a residual expanding agent content of 0.1 to 3 mass % is placed as a granulate, to at least 80% of its final volume, into a mould; then heating is carried out up to temperatures above the softening temperature of the granulate which leads to a further volume expansion and to sintering of the granulate surfaces, and the moulded article obtained is released from the mould as an insulating body (**2**) and pressed into a shell body (**1**).

16. Method according to claim 14 or **15**,

characterised in that a granulate with particle sizes in the range between 0.25 and 8 mm is used.

17. Method according to one of claims 14 to 16,

characterized in that a residual content of expanding agent in the range between 0.1 and 1 mass % is maintained.

18. Method according to one of claims 14 to 17,

characterized in that a thermally pre-expanded glass granulate, obtained from recycled glass with the addition of an organic auxiliary expanding agent, is used.

19. Method according to claim 18,

characterised in that that sugar derivative is used as the expanding agent.

20. Method according to claim 17 or **18**,

characterised in that the thermal pre-expansion is so carried out that the expanding agent fraction arises as the residual content of the expanding agent.

21. Method according to one of claims 14 to 20,

characterised in that, exploiting the heat from the firing process for producing a shell core **(1)**, pre-heated granulate is filled into the shell core **(1)** and further heating is carried out until the softening temperature of the granulate is reached and the granulate surfaces fuse.

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