(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 134 874**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **83830185.1**

(51) Int. Cl.⁴: **E 04 C 1/08**

(22) Date of filing: **26.09.83**

(30) Priority: **04.07.83 IT 820483**

(43) Date of publication of application:
27.03.85 Bulletin 85/13

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: **Vadala', Giuseppe**
Via Giovanni XXIII, 4
I-87100 Roggiano Gravina/Cosenza(IT)

(72) Inventor: **Vadala', Giuseppe**
Via Giovanni XXIII, 4
I-87100 Roggiano Gravina/Cosenza(IT)

(74) Representative: **Fiammenghi, Carlo Avv. et al,**
Via Quattro Fontane, No. 31
Rome(IT)

(54) **Highly insulating brick for masonry.**

(57) The brick consists of one or more sub-blocks (1, 2, 3). Each sub-block is divided into air chambers (4-13) of contained width but extensive in length. The walls (14, 14'; 15, 15'; 16, 16') which divide each sub-block into chambers are shaped as alternatively concave and convex arcs of a circle. The chambers are connected by septa (17, 18, 19) of minimum length. The sub-blocks are connected by septa (20, 21, 22, 23) also of minimum length and never concident with the periphery of the brick nor placed in correspondence with the inner cores of the successive sub-block, on a line with them.

Thermal bridges between the inside and outside of a wall are thus almost completely eliminated, with a brick light in weight, very strong and low in cost (Figure 1).

EP 0 134 874 A2

./...

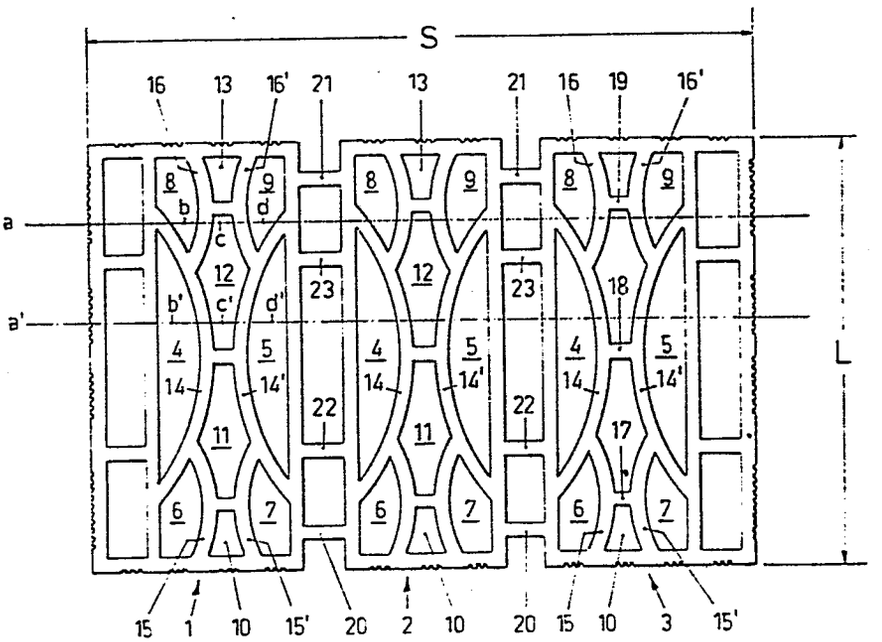
S
L
a
a'
16
13
16'
21
13
21
16
19
16'
8
9
b
d
c
12
b'
c'
d'
23
18
4
14
5
14'
22
11
17
6
7
15
1
10
15'
20
2
10
20
15
10
3
15'

FIG.1

0134874

Highly insulating brick for masonry

Name: GIUSEPPE VADALA'

The invention concerns a brick preferably made of clay for use in construction in reinforced concrete and in traditional masonry with a decisive thermal insulating function, light in weight, very strong, and low in cost, to be used as a self-supporting and/or sealing and/or partitioning element.

In residential as well as industrial construction, the structure is commonly enclosed by means of two brick walls placed at a certain distance from one another (air space). The space between the two walls is filled with an insulating material. This procedure involves very high labor costs in the construction of the two parallel walls a certain distance apart, as well as very high costs for the necessary insulating material. Moreover, the insulating material sublimes over time, that is it becomes depleted, reducing the function of the air space until it is eliminated , and with it the function of providing good insulation.

It is known that to reduce the weight and improve the insulation of a construction brick, the raw material mixture , for example of clay, is treated with combust ble organic materials like sawdust, peat, cork, coal dust

and the like. When the bricks are fired, these materials are released in gaseous form giving rise inside the brick to an alveolar configuration which has the duel effect of improving insulation and lightening the brick. However, these combustible organic materials cannot be added to the mixture beyond a certain degree since increasing the quantity considerably decreases the moldability of the mixture due to the relatively high friction of said materials. Furthermore, increasing the quantity of organic material incorporated, greatly lowers the pressure resistance since the incorporated material impeeds the natural contraction of the raw material during drying. This leads to cracks which increase because of the above mentioned friction of the incorporated material. Thus, increasing the quantity of material placed in the mixture widens the cracks so much the strength of the product is seriously reduced.

In order to overcome these problems and obtain a porous, that is insulating and light, but high strength brick or block, Italian patent 605,312 proposes incorporating in the raw material (clay, kaolin, clay schists and the like) a compressable material synthetic in nature, molding the resulting mixture to form the final product, drying it, and finally firing it. Since the incorporated material can be compressed to a smaller volume, it does not prevent contraction of the raw material during drying. Crack formation is thus substantially

reduced or even eliminated, and the compression strength of the product is not compromised. The synthetic compressable material is placed in the mixture in the form of pieces made to swell or foam, preferably in the form of small beads. For the material to be incorporated, Italian patent 605,312 proposes a synthetic material like polystyrene, phenol-plastics, polyvinyl synthetics like polyvinyl chloride, or polyesters, formaldehyde urea, polyurethane, polyethylene, polyisobutylene, latex rubber, silica and cellulose derivatives like cellulose acetate.

A brick as described has been marketed under the name "Poroton". It is rectangular is shape and subdivided by means of partitions running along its width into several chambers parallel to one another and connected by several partitions orthogonal to the former, so as to form an actual lattice. The periphery of the brick, like all its partitions, has an alveolar structure, as described below, in order to reduce weight and allow good insulation. Such a brick responds in effect, both in terms of cell-like structure and of the percent of openings (maximum 45%), that is of the empty spaces created in the chambers formed by the partitions and the cell-like structure, to the properties listed for bricks prepared with cell-like structure using compressable organic materials. However, it should be noted that the insulation is a function only of the

cell-like structure and that to obtain said structure, one must use synthetic compressable material whose cost is not negligible. On the other hand, the quantity of said material may not, even in this type of brick, exceed a certain amount, to prevent excessive weakening of hte brick itself.

In this regard, it should be noted that heat is transferred by radiation, convection and conduction. Transmission by radiation should be considered negligible, and so will not be considered. Transmission by air convection occurs vertically toward the ceiling; the quantity of heat which the air can transmit horizontally toward the outside, or vice versa, is negligible when the chambers are developed vertically, with as little horizontal development as possible. Transmission by conduction occurs through solid bodies (clay, in the present case) horizontally. Therefore, the insulation of a brick is enhanced by reducing the possibility of heat diffusion by conduction to a minimum.

In the brick in question, however, the various chambers are connected to one another, from the inside toward the outside, by several septa which form several actual heat bridges, which facilitate heat transmission by conduction in this direction to the point of cancelling the effect of the chambers presence and even reducing the insulating effect which it could have

achieved thanks to the cell-like structure.

The latter structure however is random in that it is a function of the greater or lesser regularity of the mixing of the additive with the clay. This obviously leads to the manufacture of bricks with different insulating capacities.

The aim of this invention is thus to overcome the inconveniences mentioned above by proposing a self-weight but still very strong, with low production costs and, above all, decidedly elevated insulation.

The invention achieves this by realizing a brick, preferably of clay, characterized by the fact that:

- said brick consists of one or more sub-bricks;
- each sub-brick has a rectangular peripheral outline and is subdivided by means of walls into vertical air chamber, limited in the direction of the longitudinal axis and extensive in the direction of its transverse axis;
- said walls are shaped like arcs of a circle (cores) alternatively concave and convex in the longitudinal direction of the brick;
- the centers of curvature of said circles are aligned by groups of arc along lines parallel to the longitudinal axis of the brick;
- to the width of each chamber always corresponds, in

the same longitudinal direction, a larger and respectively smaller, width of subsequent chamber;

- the convex sides of the arcs are connected to one another by rectilinear septa of minimum length, and
- the sub-blocks are connected to one another by rectilinear septa, also of minimum length, and in any case never coincident with the peripheral outline of the brick, and never placed in correspondence with the inner cores of the subse uent sub-block, in line with them.

The fundamental concept of the invention thus resides in the structural geometry with which heat transmission bridges have been substantially eliminated, by limiting the connections between sub-blocks to septa of minimum length, in any case never placed in line with cores in the same direction, and by reducing to a minimum the contact surface between the convex walls of the chambers. Since the air chambers in each sub-block must extend as much as possible in the direction of its transverse axis, the curving walls are of long radius and, consequently, their contact surfaces are the minimum. Therefore, the invention includes connection between the walls by means of septa which may be very short since they connect opposite convex walls.

According to the invention, the brick is realized preferably in clay, with no use of cell-like material.

If a further lightening of the block is desired, already in itself enhanced by the high percentage of openings due to the chambers with circular outlines, the inventor proposes as cell-forming material the final residue in the preparation of sansa oil, the cost of which is almost negligible, as can be imagined.

The structural geometry also enhances acoustic inertia. In fact, the vibratory energy hitting the exposed wall should then restart from longer walls and always different distances, since a rectilinear wall is always opposite a curved wall, and a concave curved wall is always opposite a convex one.

Finally, it should be observed that, according to the invention, the structural geometry consists of arcs and segments of a circle arranged so as to absorb compression loads in an optimal way. In fact, the resultants of all the forces acting on the arcs of the sub-block are distributed along the arcs depending on their height, and the connecting septa between the opposite convex walls of the individual chambers are placed in the points where the arcs break.

The object of the invention will be described below with reference to a preferred embodiment shown in an exemplificative and non-limiting way in the attached

drawings, where the figures show:

figure 1, an in-plane view of a brick according to the invention consisting of three sub-blocks;

figure 2, an axonometric view of a brick according to the invention laid with its openings on a vertical plane;

figure 3, an axonometric view analogous to that of figure 2 with a brick laid with its openings on a horizontal plane.

In figure 1, the brick according to the invention consists in the present case of three sub-bricks indicated generically with 1,2,3, where S indicated the width, L the length and H the height. One notes immediately that the air chambers are represented by the spaces 4-13 between arcs of a circle 14,14'; 15,15'; 16,16' arranged with concave and convex shapes opposite to one another in groups of two, and that, again in groups of two, the centers of curvature of the arcs are aligned along a single line parallel to the longitudinal axis of the brick. The connecting septa 17,18,19 between the chambers 4,5; 6,7; 8,9 are of minimum length since they connect the chambers between two convex points in their walls. Chambers 4-13 are all not very wide in the direction of the longitudinal axis of the brick, while they extend in height, that is, in the direction of the transverse axis of the brick.

For any line a parallel to the longitudinal axis of the brick, one notes how, moving it always in a parallel fashion, for example to position a', the chambers of the sub-bricks always have in this direction a width b, c, d; b', c', d' which is larger and smaller in alternate succession.

Finally, one notes how the septa 20,21 connecting sub-bocks 1,2,3 to one another are shifted toward the inside to the brick. This is done to interrupt the continuity of the thermal bridge along one external core from one sub-block to the other. The connecting septa 22,23 are also neither aligned nor in correspondence with the inner cores in the same direction, so contributing to obstruction of conduction of heat, which is dispersed instead on the walls and so vertically.

The bricks may be laid both with the openings in horizontal planes and overlapping, and with the openings in vertical planes and side by side, as shown more clearly in figures 2 and 3.

0134874

Claims

1. A brick preferably made of clay for use in construction in reinforced concrete and in traditional masonry with a decisive thermal insulating function, light in weight, very strong, and low in cost, to be used as a self-supporting and/or sealing and/or partitioning element, characterized by the fact that:
   - said brick consists of one or more sub-brick (1,2,3,);
   - each sub-brick has a rectangular peripheral outline and is subdivided by means of walls (14,14'; 15,15'; 16,16') into vertical air chambers, limited in the direction of the longitudinal axis and extensive in the direction of its transverse axis;
   - said walls are shaped like arcs of a circle (cores) alternatively concave and convex in the longitudinal direction of the brick;
   - the centers of curvature of said circles are aligned by groups of arcs along lines parallel to the longitudinal axis of the brick;
   - to the width (b, c, d, b', c', d') of each chamber always corresponds, in the same longitudinal direction, a larger, and respectively smaller, width of a subsequent chamber;
   - the convex sides of the arcs are connected to one another by rectilinear septa (17,18,19) of minimum

length, and

- the sub-blocks (1,2,3) connected to one another by rectilinear septa (20,21,22,23), also of minimum length, and in any case never coincident with the peripheral outline of the brick, and never placed in corresponence with the inner cores of the subsequent sub-block, in line with them.

2. Brick according to claim 1, characterized by the fact that the septa connecting the opposite convex walls of the individual chambers (4,5; 6,7; 8,9) are placed in the break points of the arcs.

3. Brick according to claims 1 and 2, characterized by the fact that is made of a mixture of clay and sansa residue.

0134874

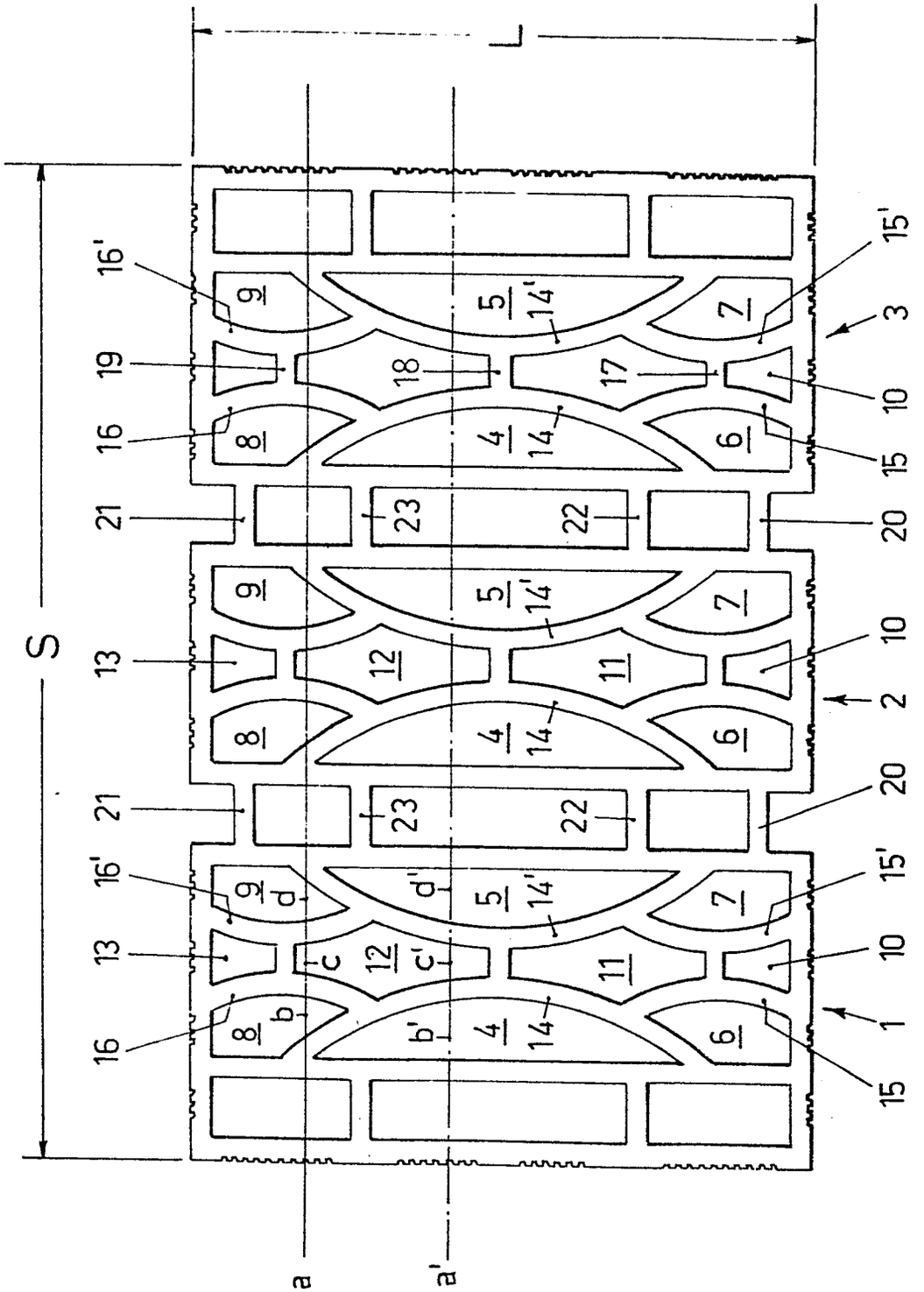

FIG.1

0134874

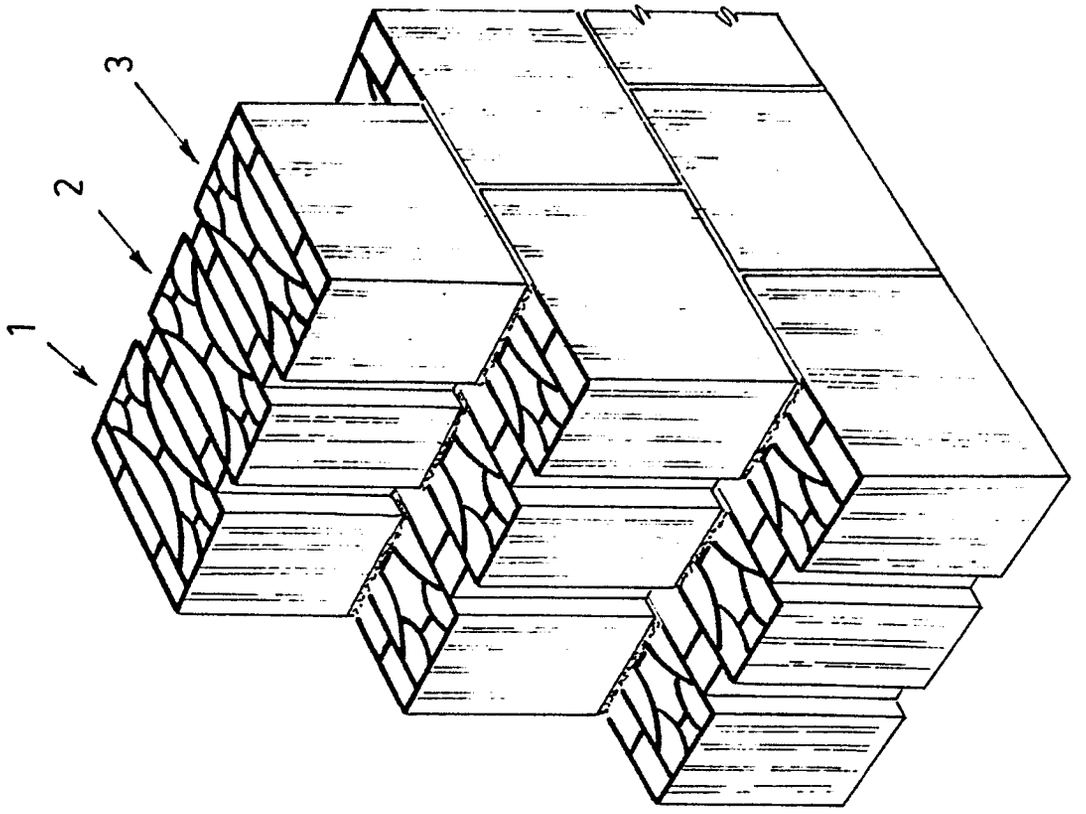

FIG.3

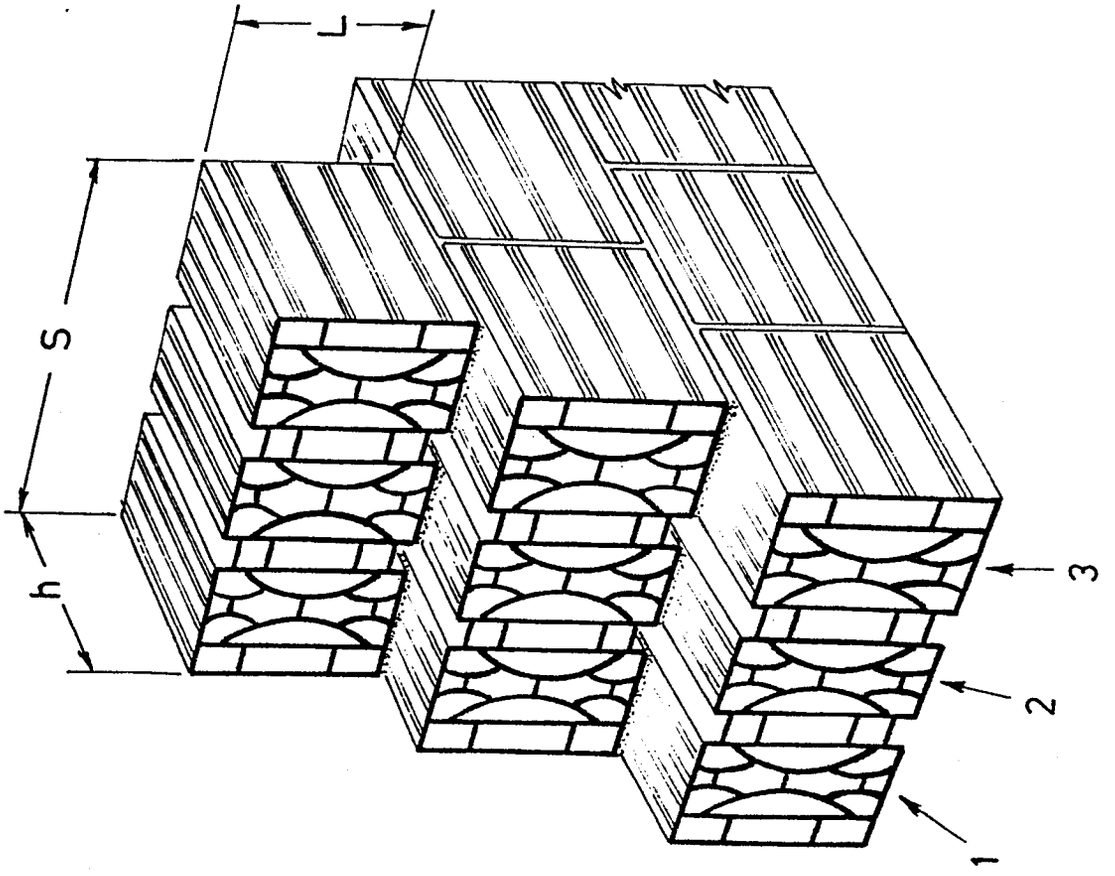

FIG.2