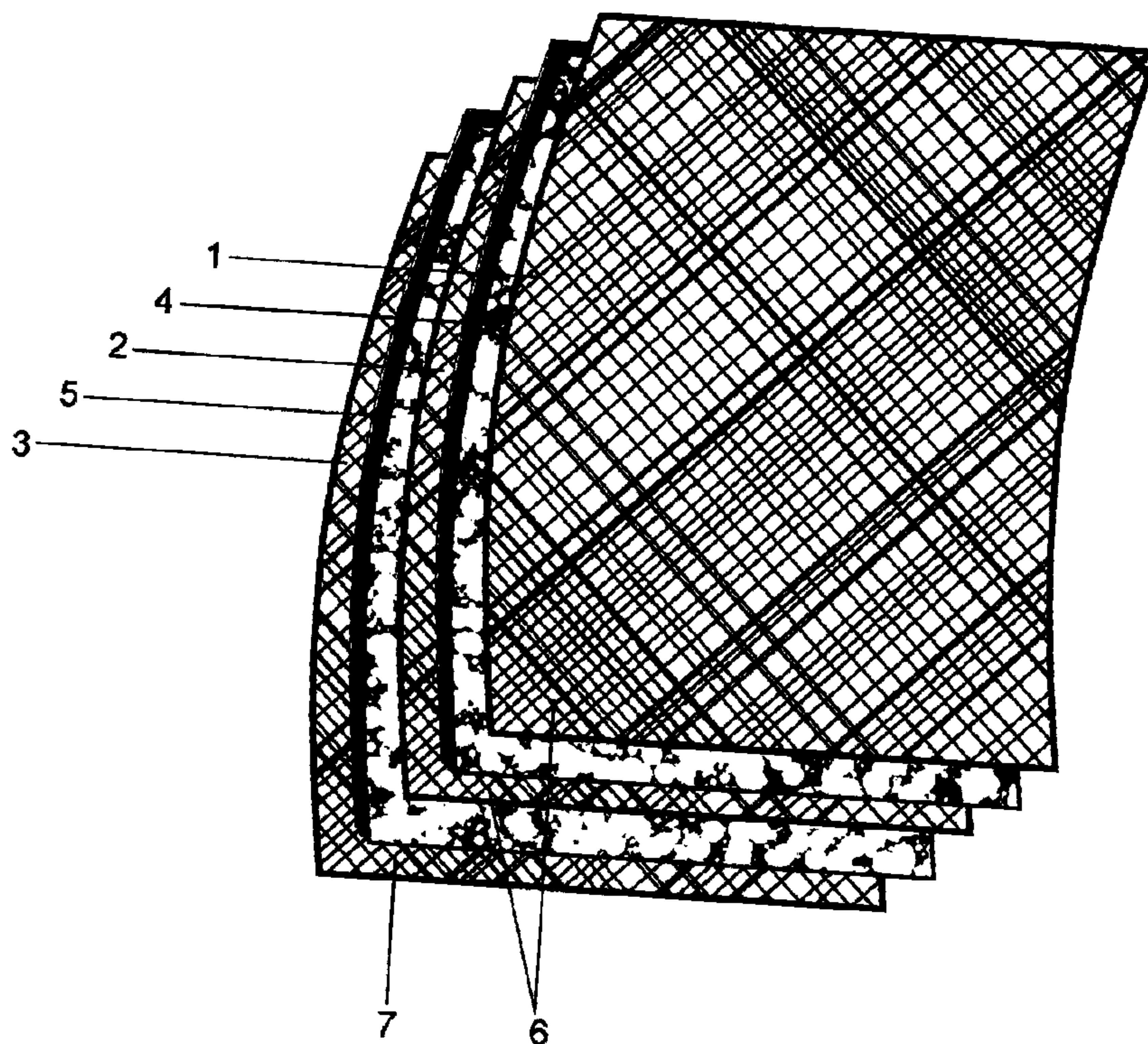




(22) Date de dépôt/Filing Date: 2008/05/05  
(41) Mise à la disp. pub./Open to Public Insp.: 2009/11/05

(51) Cl.Int./Int.Cl. *B32B 18/00* (2006.01),  
*B32B 5/08* (2006.01)  
(71) Demandeur/Applicant:  
C-BOND TECHNOLOGY INC., CA  
(72) Inventeur/Inventor:  
SCHMIDT, SIGURD F., CA

(54) Titre : COMPOSANT MOULE EN CERAMIQUE DE CONSTRUCTION EN SANDWICH AVEC NOYAU CERAMIQUE,  
RENFORCEMENT DE COUCHE DE PLATEAU ET MATRICE CERAMIQUE  
(54) Title: CERAMIC MOLDED COMPONENT OF SANDWICH CONSTRUCTION WITH CERAMIC CORE,  
DECK LAYER REINFORCEMENT, AND CERAMIC MATRIX

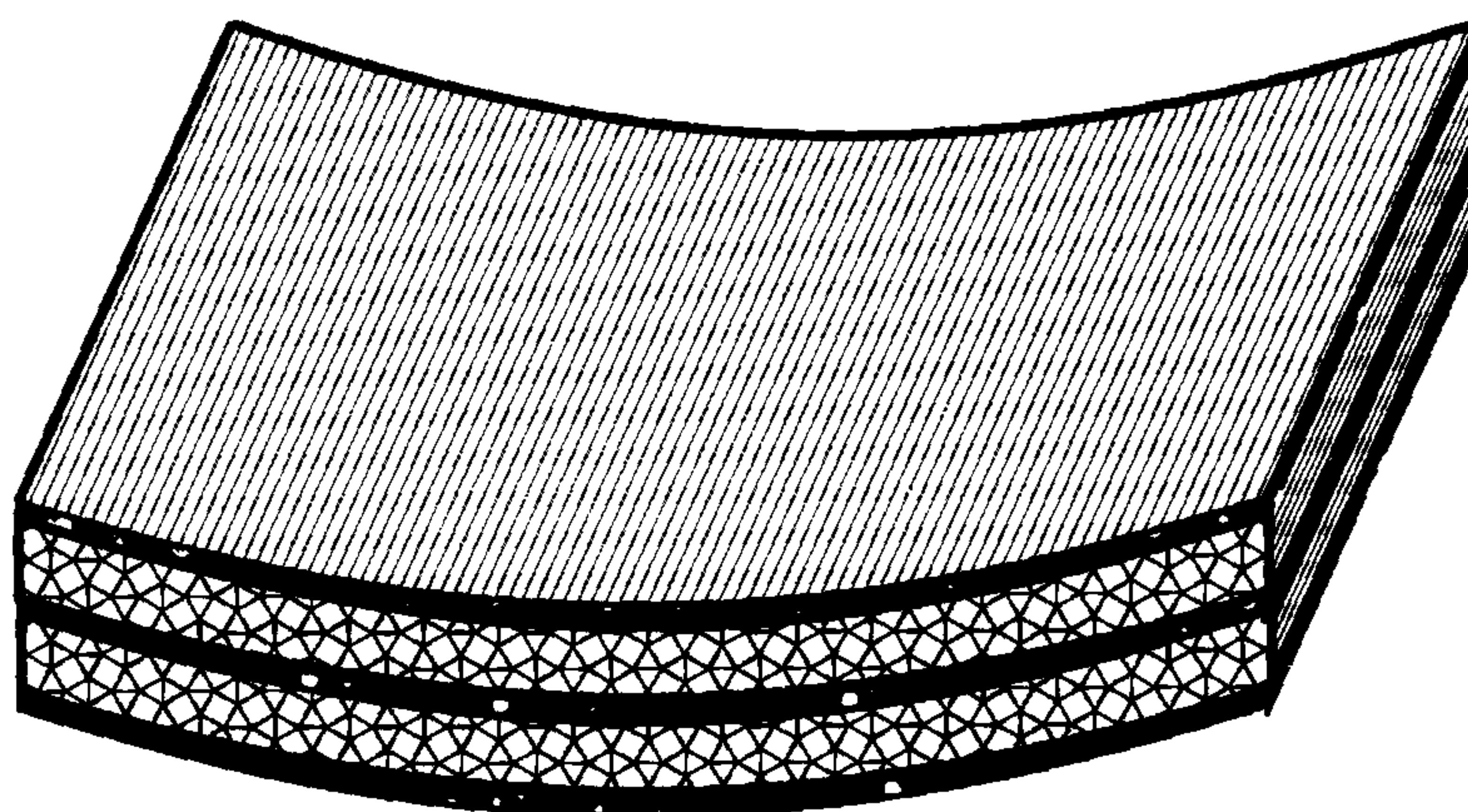


(57) **Abrégé/Abstract:**

The molded component consists of one or more deck layer(s) and a supporting core. This core also consists of one or more layers. The deck layer(s), as well as the core, are coated and impregnated by a ceramic matrix. The deck layers, as part of the molded component in the sandwich construction, have to take the principal stress; therefore, they have a special importance in absorbing tension, pressure, shear, torsion and bending stress. The invented molded component, with its fiber orientation preferably of  $\pm 45^\circ$ , will be the most efficient use of material and the best features.

## ABSTRACT

The molded component consists of one or more deck layer(s) and a supporting core. This core also consists of one or more layers. The deck layer(s), as well as the core, are coated and impregnated by a ceramic matrix. The deck layers, as part of the molded component in the sandwich construction, have to take the principal stress; therefore, they have a special importance in absorbing tension, pressure, shear, torsion and bending stress. The invented molded component, with its fiber orientation preferably of  $\pm 45^\circ$ , will be the most efficient use of material and the best features.



## DESCRIPTION

The invention is a Ceramic Molded Component consisting of a ceramic core with deck layer(s) made of tows in ceramic matrix with quasi-isotropic features. This sandwich construction has already proven its advantages in long term practice in many fields, especially in the construction industry. For instance, in a lightweight roof construction, the truss and wall panels are made by sandwich construction. In all cases, the goal is to produce a construction with minimum weight but maximum static and dynamic load, combined with fire resistance.

Sandwich parts in building construction and in civil and underground engineering are also applied to multi-layer pipes; for instance, in sewer systems or district heating. Also, there are already bridges made of molded components with fiberglass-reinforced plastics, but the parts are still heavy.

All of these conceptually excellent constructions described above have the unappreciated but irreversible disadvantages of too-high weight and/or too little bending-tension strength, combined with too much bending of the part.

Until now it was not possible to produce modern sandwich components for challenging projects, because until now construction methods used did not include the possibility of this invention; in this sense it is a real innovation. The invention described in this document can be produced today because the necessary components now exist.

The deck-layer fiber reinforcements until now are made from fabrics, stitch-bonded fabrics, or multidirectionals of different fibers. Compared with stitch-bonded fabrics or multidirectionals, the construction and production of usual fabrics causes much higher weight, combined with only a fraction of the strength.

The reinforcement is impregnated with a ceramic matrix. For practical use of the molded component, especially under tension in different directions, the prefabricated reinforcement layers have to have a different orientation. Preferably they are arranged at an angle of  $\pm 45^\circ$ . In this way, the molded component is quasi-isotropic. Together with the ceramic core, the deck layers comprise the molded component. Middle reinforcements in the same  $\pm 45^\circ$  orientation give additional very high strength and support to the ceramic core. If needed, such reinforcements can be oriented only in a crosswise direction, to strengthen the construction part. The use of other reinforcements with quasi-isotropic features like stitch-bonding reinforcements are possible. But even usual reinforcement fabrics are possible based on their lower costs (but also lower features).

Applications of the Ceramic Molded Component described here include not only panels or boards but also many other challenging applications. For example, in the field of building construction (especially fire-resistant construction). Two other examples are the field of bridge construction and for pipes in district heating, sewers, oil pipelines in polar regions etc.

**Some other applications of this invention are:**

- Basic materials for hanging, fire-resistant facades; double flooring; building material for entire houses
- Covers for cable tunnel
- Insulated pipes
- Tunnel lining
- Containers of all kinds
- Traffic management systems
- Insulated vehicles; for instance, railway cars, trucks, ships, and trailers
- Quick-build road bridges
- Pontoon bridges for military use
- Armored vehicles, bulletproof walls, etc.

These are but a few of the potential applications.

**DESCRIPTION OF  
FIGURES 1 AND 2 (BELOW)**

- 1 Upper top layer made of resin-impregnated layers with reinforcement fibers;
- 2 Middle layer to absorb the tension transverse to the long axis of the stress direction;
- 3 Lower top layer, the same as the upper top layer;
- 4 Upper core layer made of ceramic material; for instance, expanded clay, perlite, pumice or similar;
- 5 Lower core layer, the same as the upper core layer;
- 6 Upper and middle reinforcement bundles in place;
- 7 Lower reinforcement bundles in place.

# **CERAMIC MOLDED COMPONENT OF SANDWICH CONSTRUCTION WITH A CERAMIC CORE, DECK LAYER REINFORCEMENT, AND CERAMIC MATRIX**

## **PATENT CLAIMS**

1. The Ceramic Molded Component of sandwich construction, with a ceramic-bonded ceramic core and deck-layer reinforcement, is characterised by a supporting core of ceramic material with a deck layer on at least one side made of at least two single fiber-layers (for instance: multidirectional reinforcement, multiaxial reinforcement, fabric, etc.) soaked in ceramic matrix. The reinforcement layer is characterized by quasi-isotropic features.
2. The Ceramic Molded Component described in Claim 1 is characterised by an ceramic matrix for the entire component.
3. The Ceramic Molded Component described in Claim 1 is characterised by immoveable filaments which additionally will be fixed the ceramic matrix.
4. The Ceramic Molded Component described in Claim 1 is characterised by layers made of glass, carbon, aramid, polyester, acrylic, basalt, ceramic fibers or similar materials.
5. The Ceramic Molded Component described in Claim 1 is characterized by fiber deck-layer with a ceramic matrix.
6. The Ceramic Molded Component described in Claim 1 is characterised by a supporting core made of ceramic material, which is a ceramic-bonded granulate based on pumice, perlite, mica, cellular glass, expanded materials, expanded clay or gravel of any kind, or similar.
7. The Ceramic Molded Component described in Claim 1 and one of Claims 2 to 6 is characterised by one or more than one deck layer as a supporting element on the outside as well as a middle reinforcement inside, to absorb the stress of bending, tension, pressure, torsion and shear.

Figure 1

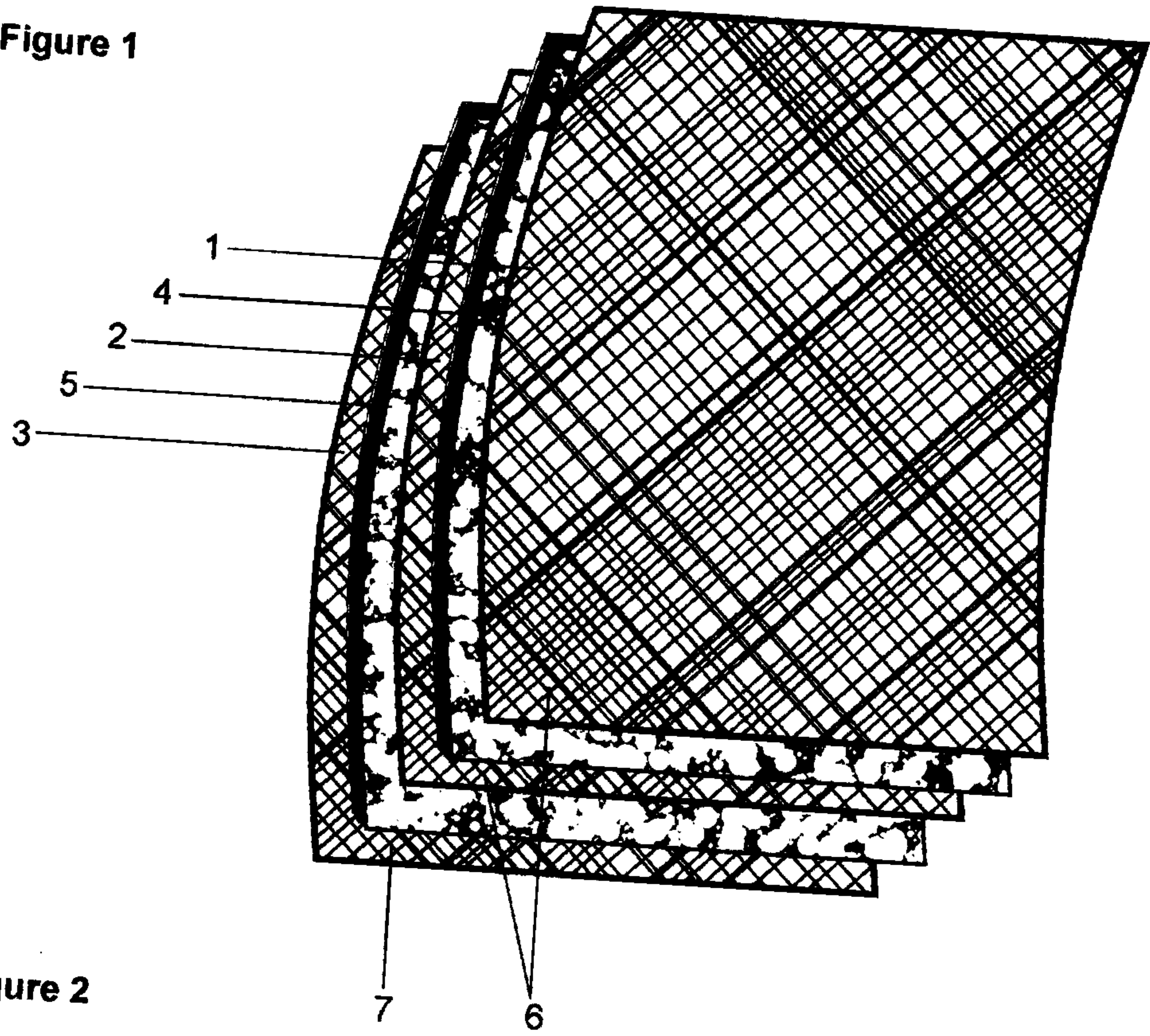


Figure 2

