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(54) FLEXIBLE, FOLDABLE AND ROLLABLE SHEET OF BRICKS, AND METHOD FOR PALLETIZING SAME

(57) The sheet of bricks (10) comprises a plurality of bricks (1) provided with openings (1a) and arranged in contiguous rows with said openings (1a) mutually aligned, spacing elements arranged to provide gaps between said rows of bricks (1), rods (2) running through the aligned openings (1a) of said bricks (1), and retaining means for retaining said rods (2) within the openings (1a) of the bricks (1). The retaining means are configured to restrict movement of the rods (2) in an axial direction with respect to the openings (1a) and to allow free rotation of the rods (2) at least within the openings (1a) of the bricks (1) in alternate rows. The bricks (1), and optionally some links (3) collaborate with the rods (2) to form a flexible chain forming the sheet of bricks (10).

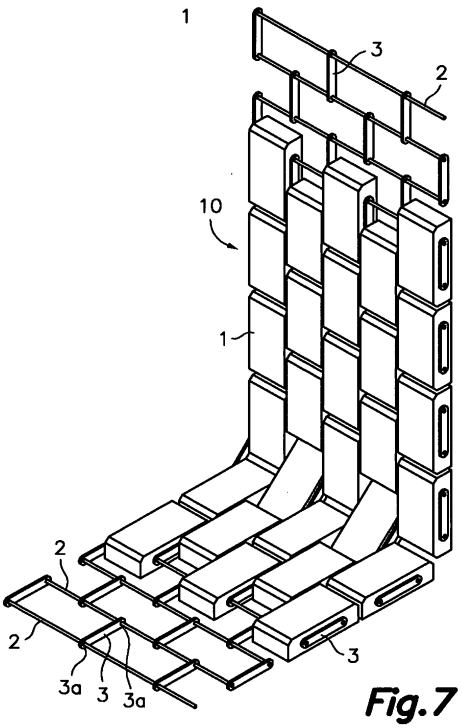

Fig.7

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Description

Field of the Art

[0001] The present invention relates to a flexible, foldable and rollable sheet of bricks, dry-manufactured and having tensile strength, suitable, for example, for building architectural elements, preferably of exposed brickwork, such as covers for terrains, floors, walls, roofs, etc., and the formation of ventilated walls.

Background of the Invention

[0002] International patent application WO 2008139008 discloses a flexible sheet of bricks comprising a plurality of flexible interwoven rods forming a grid weave, and a plurality of bricks provided with fastening configurations coupled to at least some of said rods in order to retain said bricks in said grid. The rods are advantageously wavy to immobilize the crossing points thereof in the grid. The bricks have fastening configurations, for example in the form of a channel, at their ends and during the manufacturing process they are fastened to the rods forming the warp of the weave intercalated between the rods forming the weft, which act like positioning rods to bind the weave and restrict the movements of the bricks therein. The grid optionally includes reinforcement rods arranged as warp rods in the spaces between bricks.

[0003] Although this sheet of bricks in a rod weave has offered excellent results and is useful in many applications, it does have, however, some limitations. For example, even though the sheet of bricks can be rolled up in the form of a reel on a core for storage and transport, the existence of the warp rods in the rod weave does not allow the sheet of bricks to be folded or doubled over, and this makes palletizing it difficult.

[0004] Patent FR 2 744 471 describes a prefabricated element made with bricks with openings, stacked and placed in a staggered arrangement and with the openings aligned. Washers aligned with the openings of the bricks are intercalated between bricks to leave gaps corresponding to horizontal joints. Reinforcement bars run through the aligned openings of the bricks and washers and a sealing material is injected from the upper part of the architectural element into the aligned openings of the bricks and washers, immersing the reinforcement bars. The openings of the bricks are formed perpendicular to their larger faces since the prefabricated element is envisaged for working under compression.

[0005] This prefabricated element is generally in the form of a straight wall length, though it is also envisaged that it can be, for example, in the form of a curved or angled wall length, a pillar, a bench, etc. However, regardless of its form, it has the drawback of being rigid due to the existence of the sealing material adhered to the inner surfaces of the openings of the bricks and to the reinforcement bars, and it is therefore neither foldable nor rollable and its dimensions are necessarily limited due to storage, handling and transport requirements. Another drawback of this prefabricated element is that because of its very constitution, it requires a staggered arrangement or an open arrangement of the bricks and does not allow a grid arrangement. Furthermore, the tensile strength of the prefabricated element in a direction perpendicular to the reinforcement bars is limited to the tensile strength of the bricks because they are the only binding elements in that direction. Given that the tensile strength of ceramic bricks is relatively low (for example compared with their compressive strength), the prefabricated element must be handled with certain precautions to prevent breaking it and its applications are significantly limited.

Description of the Invention

[0006] A first aspect of the present invention contributes to solving the aforementioned and other drawbacks by providing a flexible, foldable and rollable sheet of bricks, comprising a plurality of bricks provided with openings and arranged in contiguous rows with said openings mutually aligned, spacing elements arranged to provide gaps between said rows of bricks, rods running through the aligned openings of said bricks, and retaining means for retaining said rods within the openings of the bricks. The rods are sized to rotate and slide freely within the openings of the bricks and said retaining means are configured to restrict movement of the rods in an axial direction with respect to the openings and to allow free rotation of the rods at least within the openings of the bricks in alternate rows.

[0007] The aforementioned composition corresponds to a simple embodiment in which the bricks themselves, which must be in the sheet of bricks in either a compact or open staggered arrangement, cooperate with the rods to form a chain which can have a width of several rows of bricks and an indefinite length. The mentioned spacing elements can be formed in this case by washers through the holes of which the rods are inserted, or by projections formed on at least one of the faces of the bricks to contact with another adjacent brick.

[0008] Another more complex embodiment of the sheet of bricks includes, in addition to the components described above in relation to the mentioned simple embodiment, a plurality of links adjacent to one or more of the rows of bricks. Each of said links has two holes through which two of the adjacent rods are inserted. The links and the bricks are arranged such that they cooperate with the rods to form a chain, where the links take on all or most of the tensile stresses in the longitudinal direction of the chain at least partly preserving the bricks from such stresses. This composition with links allows arranging the bricks in the sheet of bricks according to a grid arrangement, in addition to the compact staggered and open staggered arrangements mentioned above for the simple embodiment.

[0009] The two holes of the links are separated by a specific distance according to the shape and dimensions of the bricks to provide gaps of a desired extension between the bricks of each row, and to allow doubling over or folding the sheet of bricks by means of a rotation of 90 degrees or more around any of the rods without the bricks interfering with each other. Here, the mentioned spacing elements are formed by the links, which have, in at least regions around the holes, a thickness sized to provide gaps of a desired width between the rows of bricks. Obviously, some links can be replaced with washers of equivalent thickness in one or more of the gaps between the rows of bricks provided that the remaining links and/or the bricks assure the functional and mechanical features of the sheet of bricks.

[0010] Both in the simple embodiment without links and in the complex embodiment with links, the mentioned retaining means can be formed, for each rod, by a ring-shaped plug, preferably made from an elastic material, such as an elastomer, arranged between an outer surface of the end of the rod and an inner surface of the opening of the brick or hole of the link. The mentioned ring-shaped plug can be formed, for example, by injecting a sufficient amount of silicone in liquid or pasty state into the corresponding holes of the brick located in one or both side edges of the sheet of bricks. This ring-shaped plug has the advantage of allowing retention of the rod without it projecting from the hole of the brick. Alternatively, the retaining means comprise, in at least one side edge of the sheet of bricks, a connecting element arranged in the longitudinal direction and attached at its ends to ends of two adjacent rods projecting from the bricks. This connecting element can be fixed, for example by welding or adhesive, to the ends of the rods, or it can be formed integrally with the two adjacent rods, such that the two rods and the connecting element are obtained from a single bent U-shaped rod part. Another alternative form for the retaining means comprises, in at least one side edge of the sheet of bricks, a stop fixed at one end of the rod projecting from the brick. Optionally, a link can be located adjacent to the outer face of the brick located in the side edge of the sheet of bricks, in which case said stop is fixed at one end of the rod projecting from the link. The stop will be sized, respectively in each case, so as to not pass through the opening of the brick or the hole of the link.

[0011] The term "brick" is used throughout this description to generically refer to a body with an essentially orthoedric shape, primarily made from a ceramic material, cement material, or a stone material, although other materials are not discarded. In a typical embodiment of the present invention, the orthoedric-shaped bricks have two opposite wide faces and two opposite narrow faces elongated in the longitudinal direction and two other opposite narrow faces elongated in the transverse direction, and the openings extend parallel to the transverse direction and have orifices in both of said two opposite narrow faces elongated in the longitudinal direction. This means that in this embodiment the sheet of bricks has a relatively thin general thickness, equivalent to the smaller dimension of the bricks, whereas the larger faces of the bricks are exposed. Nevertheless, bricks with a square base or cubic configuration, or even elongated in the transverse direction, are also within the scope of the present invention.

[0012] The sheet of bricks preferably has a dimension in the longitudinal direction and a dimension in the transverse direction, where the rows of bricks are arranged parallel to said longitudinal direction and the rods are arranged parallel to the transverse direction. As a result of this arrangement, the sheet of bricks can be doubled over or folded in a zigzag arrangement around one or more of the rods to reduce the space it occupies in the longitudinal direction, which is especially advantageous when the longitudinal dimension is significantly longer than the transverse dimension, without overlooking that it can also be rolled up in the form of a reel on a core. It will nevertheless be understood that a sheet of bricks with a square base or even with the transverse dimension longer than the longitudinal dimension is also within the scope of the present invention.

[0013] According to a second aspect, the present invention provides a method for palletizing a flexible, foldable and rollable sheet of bricks. The method comprises first providing a sheet of bricks according to the simple embodiment of the first aspect of the present invention described above or a sheet of bricks according to the complex embodiment provided with links described above. The method then comprises placing a portion of the sheet of bricks on a pallet, and next doubling over or folding the sheet of bricks in a zigzag arrangement around one or more of the rods to form two or more lengths of sheet of bricks overlaid on said pallet. One way of carrying out to practice the method of the invention comprises vertically supporting the sheet of bricks with a lower edge thereof adjacent to a side edge of the pallet, and performing a vertical downward movement of the sheet of bricks in relation to the pallet in combination with horizontal back and forth movements of the sheet of bricks in relation to the pallet. The mentioned horizontal back and forth movements will logically have a width selected according to the dimensions of the pallet. For example, a fork lift truck, a crane, or another similar machine can be used to vertically support the sheet of bricks and to make said vertical downward and horizontal back and forth movements of the sheet of bricks in relation to the pallet, although other means could alternatively be used to move the sheet of bricks, to move the pallet, or to move both.

Brief Description of the Drawings

[0014] The aforementioned and other features and advantages will be better understood from the following detailed description of embodiments in reference to the attached drawings, in which:

Figure 1 is a perspective view of a flexible, foldable and rollable sheet of bricks according to a simple embodiment of the present invention with bricks placed in a compact staggered arrangement, in a bent position;
Figure 2 is a partial plan view of an enlarged detail of the sheet of bricks of Figure 1;
Figure 3 is a perspective view of one of the bricks forming part of the sheet of bricks of Figure 1;
Figure 4 is a perspective view of a flexible, foldable and rollable sheet of bricks according to another simple embodiment of the present invention with bricks placed in an open staggered arrangement, in a bent position;
Figure 5 is a partial plan view of an enlarged detail of the sheet of bricks of Figure 4;
Figure 6 is a perspective view of one of the bricks according to a configuration useful for being part of either the sheet of bricks of Figure 4 or the sheet of bricks of Figure 11;
Figure 7 is a perspective view of a flexible, foldable and rollable sheet of bricks according to a complex embodiment of the present invention with bricks placed in a compact staggered arrangement, in a bent position;
Figure 8 is a partial plan view of an enlarged detail of the sheet of bricks of Figure 7;
Figure 9 is a perspective view of one of the bricks according to a configuration suitable for being part of either the sheet of bricks of Figure 7 or the sheet of bricks of Figure 15;
Figure 10 is a perspective view of one of the links according to a configuration useful for being part of either the sheet of bricks of Figure 7 or the sheet of bricks of Figure 15;
Figure 11 is a perspective view of a flexible, foldable and rollable sheet of bricks according to another complex embodiment of the present invention with bricks placed in an open staggered arrangement, in a bent position;
Figure 12 is a partial plan view of an enlarged detail of the sheet of bricks of Figure 11;
Figure 13 is a perspective view of a brick according to an alternative configuration useful for being part of either the sheet of bricks of Figure 7, the sheet of bricks of Figure 11 or the sheet of bricks of Figure 15;
Figure 14 is a perspective view of a link forming part of the sheet of bricks of Figure 11;
Figure 15 is a perspective view of a flexible, foldable and rollable sheet of bricks, according to yet another complex embodiment of the present invention with bricks placed in a grid arrangement, in a bent position;
Figure 16 is a partial plan view of an enlarged detail of the sheet of bricks of Figure 15;
Figure 17 is a perspective view of a single bent U-shaped rod part provided by a pair of adjacent rods, a connecting element between them and retaining means that can be applied to the sheet of bricks according to any one of its simple or complex embodiments;
Figures 18 and 19 are side and top views, respectively, of two links according to two alternative configurations useful for being part of the sheet of bricks according to any one of its complex embodiments;
Figures 20, 21 and 22 are partial cross-section views of retaining means according to three alternative configurations that can be applied to the sheet of bricks according to any one of its simple or complex embodiments;
Figure 23 is a perspective view illustrating a method for palletizing a flexible sheet of bricks according to the present invention;
Figure 24 is a perspective view of a flexible sheet of bricks with a grid arrangement according to the present invention folded in a zigzag arrangement on a pallet;
Figure 25 is a perspective view of a flexible sheet of bricks with a compact staggered arrangement according to the present invention folded in a zigzag arrangement on a pallet; and
Figure 26 is a perspective view of a flexible sheet of bricks with an open staggered arrangement according to the present invention folded in a zigzag arrangement on a pallet.

Detailed Description of Exemplary Embodiments

[0015] Referring first to Figures 1 to 3 and Figures 4 to 6, two simple embodiments of a flexible, foldable and rollable sheet of bricks 10 of the present invention are described. In both simple embodiments, the mentioned sheet of bricks 10 comprises a plurality of bricks 1 generally identical to one another arranged in contiguous rows parallel to a longitudinal direction. Each of the bricks 1 (Figures 3 and 6) has a body that has an essentially orthoedric shape elongated in said longitudinal direction and has two opposite wide faces 31 and two opposite narrow faces 32 elongated in the longitudinal direction and two opposite narrow faces 33 elongated in the transverse direction. Each brick 1 comprises a pair of through openings 1 a extending parallel to said transverse direction from one another of said two opposite narrow faces 32 elongated in the longitudinal direction. The bricks can have other openings, cavities or orifices in addition to the mentioned openings 1a.

[0016] In the sheet of bricks 10 shown in Figures 1 and 2, the rows of bricks 1 are arranged with the bricks 1 in a compact staggered arrangement, whereas in the sheet of bricks 10 shown in Figures 4 and 5, the rows of bricks 1 are arranged with the bricks 1 in an open staggered arrangement, differing from the compact staggered arrangement in that it leaves considerably wide gaps between the opposite narrow faces 33 elongated in the transverse direction of the adjacent bricks 1 of the same row. These gaps between bricks of the same row are

determined by the distance between the openings 1a in relation to the total length of the bricks 1, such distance between the openings 1a being longer in the open staggered arrangement than in the compact staggered arrangement for the same length of brick 1. In both arrangements, the respective openings 1a of the bricks 1 of the adjacent rows are mutually aligned, and rods 2 run through these aligned openings 1a of the bricks 1. Retaining means are provided for retaining said rods 2 within the openings 1a of the bricks 1 and spacing elements are provided to provide gaps between the rows of bricks 1, which will be described in detail below.

[0017] The rods 2 and the openings 1a of the bricks 1 are sized such that the rods 2 can rotate and slide freely within the openings 1a, and the mentioned retaining means are configured to restrict transverse movements of the rods 2, i.e., in the axial direction of the openings 1a, and to allow free rotation of the rods 2 at least within the openings 1a of the bricks 1 in alternate rows, such that the bricks 2 cooperate with the rods 2 to form a flexible chain with a width corresponding to a number of rows of bricks 1 and a length limited only by the handling possibilities of the sheet of bricks. This chain constitutes the sheet of bricks 10, which can be doubled over or folded around one or more of the rods 2 to adapt to different shapes, surfaces, contours and configurations. Several examples of retaining means will be described in detail below in relation to Figures 17, 20, 21 and 22.

[0018] Given that the sheet of bricks 10 is elongated in the longitudinal direction, i.e., has a dimension in the longitudinal direction significantly longer than a dimension in the transverse direction, and given that the rows of bricks 1 are arranged parallel to the longitudinal direction and that the rods 2 are arranged parallel to the transverse direction, the flexibility capacity of the sheet of bricks 10 can be used to reduce the space it occupies in the longitudinal direction to facilitate handling and storage. For example, the sheet of bricks 10 can be folded in a zigzag arrangement by means of a rotation of 90 degrees or more around several of the rods 2, or it can be rolled up around a core. To facilitate folding, the bricks 1 can include bevels 34 between one of the opposite wide faces 31 elongated in the longitudinal direction and the two opposite narrow faces 33 elongated in the transverse direction.

[0019] In the simple embodiment shown in Figures 1 to 3, each brick 1 comprises projections 7 formed in its opposite narrow faces 32 elongated in the longitudinal direction. These projections 7 are positioned to contact with one of the opposite narrow faces 32 elongated in the longitudinal direction of another brick 1 of an adjacent row. Therefore, the projections 7 act as the mentioned spacing elements to provide suitable gaps between the rows of bricks 1.

[0020] In the other simple embodiment shown in Figures 4 to 6, the spacing elements are formed by washers 6, having a thickness corresponding to the desired gap, arranged between the rows of bricks 1. Each washer 6 has a hole aligned with the holes 1a of the adjacent bricks 1, and the rods 2 are inserted through the holes 1a of the bricks 1 and through the holes of the washers 6.

[0021] It will be understood that a sheet of bricks 10 can alternatively be formed with a compact staggered configuration as shown in Figure 1 using washers 6 as spacing elements as shown in Figure 4 instead of the projections 7 in the bricks 1, and a sheet of bricks 10 can inversely be formed with an open staggered configuration as shown in Figure 4 using projections 7 in the bricks 1 as shown in Figure 1 as spacing elements instead of washers 6.

[0022] Referring now to Figures 7 to 10, Figures 11 to 14, and Figures 15 and 16, three complex embodiments of the flexible, foldable and rollable sheet of bricks 10 of the present invention are described. The sheets of bricks 10 of the complex embodiments are similar to the sheets of bricks 10 of the simple embodiments described above except that the sheets of bricks 10 of the complex embodiments include, in addition to the bricks 1, rods 2, spacing elements (optional in this case) and retaining means, a plurality of links 3 adjacent to one or more of the rows of bricks 1. Each link (see Figures 10 and 14) has two holes 3a through which two of the adjacent rods 2 are inserted, such that the links 3 and the bricks 1 cooperate with the rods to form the chain constituting the sheet of bricks. The links 3 can be located between every two rows of bricks 1 and have a thickness suitable for acting as the spacing elements between the rows of bricks, or they can be arranged leaving empty spaces which can be occupied, for example, by washers 6 similar to those described in relation to Figures 4 and 5 to act as spacing elements in combination with links 3.

[0023] In the complex embodiment shown in Figures 7 and 8, the rows of bricks 1 are placed with the bricks 1 in a compact staggered arrangement, using bricks as shown in Figure 9, which are similar to that described above in relation to Figure 3 but without the projections 7, in combination with links 3 as shown in Figure 10, which have two holes 3a located at the same distance as the openings 1a of the brick 1 shown in Figure 9.

[0024] In the sheet of bricks 10 shown in Figures 11 and 12, the rows of bricks 1 are placed with the bricks 1 in an open staggered arrangement, using bricks similar to those described above in relation to Figure 6, in which the openings 1a are more separated from one another than in the brick 1 shown in Figure 9, although both bricks have the same outer configuration, in combination with links 3 as shown in Figure 14, which have the two holes 3a located at the same distance as the openings 1a of the brick 1 shown in Figure 6.

[0025] The incorporation of the links 3 allows additionally placing the rows of bricks 1 with the bricks 1 in a grid arrangement like in the complex embodiment shown in Figures 15 and 16, which cannot be done with the simple embodiments. Bricks 1 as shown in Figure 9 in combination with links 3 as shown in Figure 10 can be used to form this sheet of bricks 10 with a grid arrangement. Here,

in some sections only links 3 cooperate with rods 2 to form the flexible chain constituting the sheet of bricks 10. It must be noted that by using the same bricks 1 of Figure 9, the same links 3 of Figure 10 and the same rods 2 both the sheet of bricks 10 with the compact staggered arrangement of Figures 7 and 8 and the sheet of bricks 10 with the grid arrangement of Figures 15 and 16 can be formed by simply varying the placement of the bricks 1.

[0026] Alternatively, bricks 1 as shown in Figure 13 can also be used to form the sheets of bricks 10 according to any one of the two simple embodiments shown in Figures 1 to 3 and 4 to 6 or of the three complex embodiments shown in Figures 7 to 10, in Figures 11 to 14 and in Figures 15 and 16. Said bricks 1 as shown in Figure 13 include a first pair of openings 1a located in positions suitable for the compact staggered arrangement and for the grid arrangement and a second pair of openings 1b located in positions suitable for the open staggered arrangement, which allows obtaining sheets of bricks having different arrangements with a single type of brick 1 by simply choosing the pair of openings 1a or 1b suitable for each case.

[0027] Figures 20, 21 and 22 show several alternative examples for the mentioned retaining means. In the example of Figure 20, the retaining means comprise, in at least one side edge of the sheet of bricks 10, a ring-shaped plug 4 arranged between an inner surface of the opening 1a of the brick 1 and an outer surface of the end of the rod 2. The ring-shaped plug 4 is preferably made from an elastic material, such as an elastomer, which adheres by friction to the surfaces of the rod 2 and of the opening 1a of the brick 1, and more preferably made from silicone applied by injecting silicone in a liquid or pasty state into the opening 1a in the presence of the rod 2. The ring-shaped plug 4 provides retention of the rod sufficient for most applications and has the advantage of retaining the rod 2 inside the opening 1a of the brick 1 without the rod 2 laterally projecting from the brick 1, as shown in Figure 20. The ring-shaped plug 4 makes the free rotation of the rod 2 with respect to the brick 1 difficult, but this is not a drawback if ring-shaped plugs 4 are only installed in bricks 1 of alternate rows, or in bricks of the end rows if there is an uneven number of rows in the sheet of bricks 10, or in bricks of the end rows if retaining means of another type are installed at the opposite ends.

[0028] In the examples shown in Figures 21 and 22, the retaining means comprise, in at least one side edge of the sheet of bricks 10, a stop 5 fixed at one end of the rod 2. This stop 5 is larger than the openings 1a of the brick 1, such that it cannot pass through the corresponding opening 1a and retains the movement of the rod 2 in an axial direction without preventing its free rotation with respect to the brick 1. In the example of Figure 21, the stop 5a is provided by a washer 35 provided with a hole through which a projecting end of the rod 2 runs, and said washer 35 is fixed to the rod 2 by an adhesive or weld 36. In the example of Figure 22, the stop 5a is provided by a retaining washer 37 provided with a hole through which a projecting end of the rod 2 runs and with flexible pins 38 extending toward the inside of the hole and elastically pressing against the outer surface of the rod 2. This retaining washer 37 can be installed under pressure without the need for adhesive or welding and provides retention sufficient for most applications.

[0029] Figure 17 shows a bent U-shaped rod part 39 defined by a pair of parallel rods 2 connected at their ends by a connecting element 2a having a length suited to the distance between the two openings 1a or 1b of the bricks 1. The two parallel rods 2 can therefore be used as two of the adjacent rods 2 in the sheet of bricks 10 and the connecting element 2a acts as the retaining means for retaining the two rods 2 against movements in an axial directions with respect to one or two bricks 1 in a side edge of the sheet of bricks 10. Furthermore, the connecting element 2a, which is arranged in the longitudinal direction, acts as a spacing element when this side edge of the sheet of bricks 10 is placed adjacent to an opposite side edge of another sheet of bricks 10 from which the ends of the corresponding rods 2 do not project because they are, for example, retained by means of ring-shaped plugs 4 like those described above in relation to Figure 20. The bent U-shaped rod part 39 can be applied to the sheet of bricks 10 according to any one of the simple or complex embodiments of the present invention.

[0030] It will be understood that the two rods 2 and the connecting element 2a can alternatively be independent parts attached to one another, for example by adhesive or welding, instead of a single bent U-shaped rod part 39. Figures 7, 11 and 15 show links 3 adjacent to the bricks 1 in one of the side edges of the sheet of bricks 1. These outer links can be fixed to projecting ends of the rods 2, for example by adhesive or welding, or by means of ring-shaped plugs similar to those described above in relation to Figure 20 arranged between an outer surface of the rod 2 and an inner surface of the hole 3a of the link 3, such that the outer links 3 act as connecting elements and retaining means in this side edge of the sheet of bricks 10. In any case, the connecting elements 2a will be arranged in the longitudinal direction of the sheet of bricks 10 and attached at its ends to ends of two of the adjacent rods 2.

[0031] Generally, two holes 3a of the links 3 are separated by a specific distance according to the shape and dimensions of the bricks 1 to provide gaps of a desired extension between the bricks 1 of each row. These gaps must allow doubling over or folding the sheet of bricks 10 by means of a rotation of 90 degrees or more around any of the rods 2. In some applications, it may be appropriate for one or both holes 3a of each link 3 to be holes elongated in the longitudinal direction of the link 3 to allow certain play in the positions of the rods and the bricks.

[0032] Figure 18 shows a link 3 according to an alternative configuration including a single elongated orifice encompassing the two holes 3a. This link 3 of Figure 18 can be formed, for example, by a suitably bent rod part

and with the ends attached, for example, by adhesive or welding 40.

[0033] Figure 19 shows a link 3 according to another alternative configuration provided for additionally acting as a spacing element to provide relatively wide gaps. To that end, the link 3 comprises an elongated body with two holes 3a separated by a required distance and thickened regions 41 around the holes 3a. These thickened regions 41 have a thickness sized to provide gaps of a desired width between the rows of bricks 1, whereas a connecting portion 42 between said thickened regions 41 only has the thickness necessary for assuring a required tensile strength.

[0034] In any of the simple and complex embodiments of the present invention, the bricks 1 can be made from a variety of materials, although a ceramic material, a cement material, or a stone material is preferred. The rods 2 can be made from relatively rigid materials, such as steel or other metal alloys, or optionally fiber-reinforced plastic or synthetic materials, or of relatively flexible materials, such as steel cables, nylon cables and the like. The material for the links 3 and the spacing washers 6, when there are any, will preferably be a metal material, such as steel or aluminum, or a plastic or synthetic material. For applications in which the rods 2 and the links 3 are exposed to the elements, the material of the rods and the links is preferably resistant to corrosion, such as for example stainless steel, galvanized steel, painted steel, aluminum, or a plastic or synthetic material.

[0035] Now in reference to Figure 23, there is described a method for palletizing a flexible, foldable and rollable sheet of bricks 10 according to any one of the simple and complex embodiments of the present invention described above. The method comprises placing a length of said sheet of bricks 10 on a pallet 8 and doubling over or folding the sheet of bricks in a zigzag arrangement 10 around one or more of the rods 2 to form two or more lengths of sheet of bricks 10 overlaid on said pallet 8. To do so, the sheet of bricks 10 can be vertically supported by lifting means such as, for example, a fork lift truck, a crane, or the like, and said lifting means can be operated first for placing a lower edge of the sheet of bricks 10 adjacent to a side edge of the pallet 8, and next for performing a vertical downward movement of the sheet of bricks 10 in relation to the pallet 8 in combination with horizontal back and forth movements of the sheet of bricks 10 in relation to the pallet 8 with a width selected according to the dimensions of the pallet 8 to deposit a first length of said sheet of bricks 10 on the pallet 8 and successive lengths folded in a zigzag arrangement overlaid on the first one.

[0036] In the example shown in Figure 23, a load bar 43 connected to lifting means (not shown), and hooks 44 fastened on one side to said load bar 43 and hooked on the other side to the last rod 2 of the sheet of bricks 10 are used to fasten the sheet of bricks 10 to the lifting means. In the example illustrated, the sheet of bricks 10 comprises links 3, and a group of end links 3 project from the end of the sheet of bricks 10 to support an auxiliary rod 2 which can be installed through the free holes 3a of the end links 3 to perform the handling operations of the sheet of bricks 10 and can be removed when it is no longer necessary.

[0037] Figures 24, 25 and 26 show sheets of bricks 10 according to different embodiments of the first aspect of the present invention doubled over in a zigzag arrangement in four lengths overlaid and placed on respective pallets 8 according to the method for palletizing of the second aspect of the present invention. The sheet of bricks of Figure 24 has the bricks 1 arranged in a grid arrangement, the sheet of bricks 10 of Figure 25 has the bricks 1 arranged in a compact staggered arrangement, and the sheet of bricks 10 of Figure 26 has the bricks 1 arranged in an open staggered arrangement, as described above. The palletized sheets of bricks 10 can be stored in an orderly fashion, occupying relatively little space, and can be comfortably handled by means of a fork lift truck.

[0038] Modifications and variations to the embodiments shown and described will occur to person skilled in the art without departing from the scope of the present invention as it is defined in the attached claims.

Claims

1. A flexible, foldable and rollable sheet of bricks, of the type comprising:

   a plurality of bricks (1) provided with openings (1a) and arranged in contiguous rows with said openings (1a) mutually aligned;
   spacing elements arranged to provide gaps between said rows of bricks (1);
   rods (2) running through the aligned openings (1a) of said bricks (1); and
   retaining means for retaining said rods (2) within the openings (1a) of the bricks (1),
   characterized in that the rods (2) are sized to rotate and slide freely within the openings (1a) of the bricks (1) and said retaining means are configured to restrict movement of the rods (2) in an axial direction with respect to the openings (1a) and to allow free rotation of the rods (2) at least within the openings (1a) of the bricks (1) in alternate rows.

2. The sheet of bricks according to claim 1, **characterized in that** it includes a plurality of links (3) adjacent to one or more of the rows of bricks (1), where each link has two holes (3a) through which two of the adjacent rods (2) are inserted, and where said links (3) and the bricks (1) are arranged forming a chain in cooperation with the rods (2).

3. The sheet of bricks according to claim 1 or 2, **char-**

acterized in that said bricks (1) have an essentially orthoedric shape.

4. The sheet of bricks according to claim 1, 2 or 3, **characterized in that** the sheet of bricks has a dimension in a longitudinal direction and a dimension in a transverse direction, where the rows of bricks (1) are arranged parallel to said longitudinal direction and the rods (2) are arranged parallel to said transverse direction, so the sheet of bricks can be doubled over or folded in a zigzag arrangement around one or more of the rods (2) to reduce the space it occupies in the longitudinal direction.

5. The sheet of bricks according to any one of claims 1 to 4, **characterized in that** the bricks (1) in the sheet of bricks are in an arrangement selected from compact staggered and open staggered arrangement.

6. The sheet of bricks according to any one of claims 2 to 4, **characterized in that** the bricks (1) in the sheet of bricks are in an arrangement selected from a grid, compact staggered and open staggered arrangement.

7. The sheet of bricks according to claim 6, **characterized in that** the two holes (3a) of the links (3) are separated by a specific distance according to the shape and dimensions of the bricks (1) to provide gaps of a desired extension between the bricks (1) of each row, and to allow doubling over or folding the sheet of bricks by means of a rotation of at least 90 degrees around any of the rods (2).

8. The sheet of bricks according to claim 6 or 7, **characterized in that** said spacing elements are formed by the links (3), which have, at least in regions around the holes (3a), a thickness sized to provide gaps of a desired width between the rows of bricks (1).

9. The sheet of bricks according to claim 5, **characterized in that** said spacing elements are selected from washers (6) through the holes of which the rods (2) are inserted and projections (7) formed on at least one of the faces of the bricks (1) to contact with another adjacent brick (1).

10. The sheet of bricks according to any one of claims 1 to 5, **characterized in that** said retaining means comprise, in at least one side edge of the sheet of bricks, a ring-shaped plug (4) arranged between an outer surface of the end of the rod (2) and an inner surface of the opening (1a) of the brick (1) or hole (3a) of the link (3).

11. The sheet of bricks according to any one of claims 1 to 5, **characterized in that** said retaining means comprise, in at least one side edge of the sheet of bricks, a connecting element (2a) arranged in the longitudinal direction and attached at its ends to ends of two adjacent rods (2) or formed integrally with the two rods (2) as a single bent rod part (39).

12. The sheet of bricks according to any one of claims 1 to 5, **characterized in that** said retaining means comprise, in at least one side edge of the sheet of bricks, a stop (5) fixed at one end of the rod (2), said stop (5) being sized so as to not pass through the corresponding opening (1a) of the brick (1) or hole (3a) of the link (3).

13. A method for palletizing a flexible, foldable and rollable sheet of bricks, **characterized in that** it comprises the steps of:

providing a sheet of bricks (10) comprising a plurality of bricks (1) provided with openings (1a) and arranged in contiguous rows with said openings (1a) mutually aligned, spacing elements arranged to provide gaps between said rows of bricks (1), rods (2) running through the aligned openings (1a) of said bricks (1); and retaining means for retaining said rods (2) within the openings (1a) of the bricks (1), where the rods (2) are sized to rotate and slide freely within the openings (1a) of the bricks (1) and said retaining means are configured to restrict movement of the rods (2) in an axial direction with respect to the openings (1a) and to allow free rotation of the rods (2) at least within the openings (1a) of the bricks (1) in alternate rows;
placing a length of said sheet of bricks (10) on a pallet (8); and
doubling over or folding the sheet of bricks (10) in a zigzag arrangement around one or more of the rods (2) to form two or more overlaid lengths of sheet of bricks (10) on said pallet (8).

14. The method according to claim 13, **characterized in that** it comprises vertically supporting the sheet of bricks (10) with a lower edge thereof adjacent to a side edge of the pallet (8), and performing a vertical downward movement of the sheet of bricks (10) in relation to the pallet (8) in combination with horizontal back and forth movements of the sheet of bricks (10) in relation to the pallet (8) with a width selected according to the dimensions of the pallet (8).

15. The method according to claim 14, **characterized in that** it comprises using lifting means to vertically support the sheet of bricks (10) and to perform said vertical downward and horizontal back and forth movements of the sheet of bricks (10) in relation to the pallet (8).

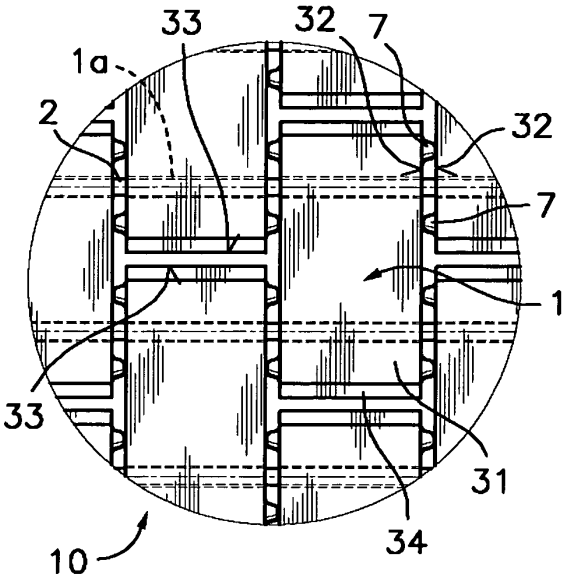

Fig.2

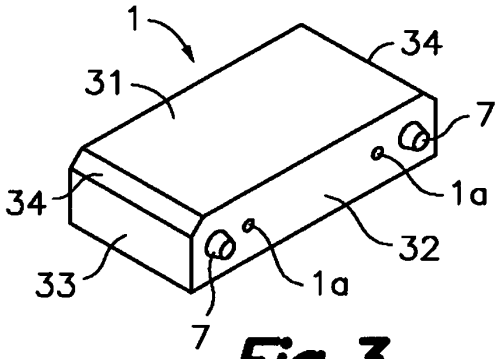

Fig.3

Fig.1

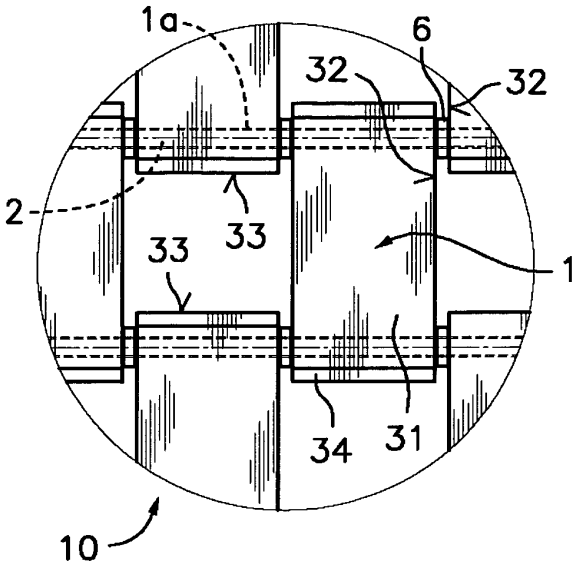

Fig.5

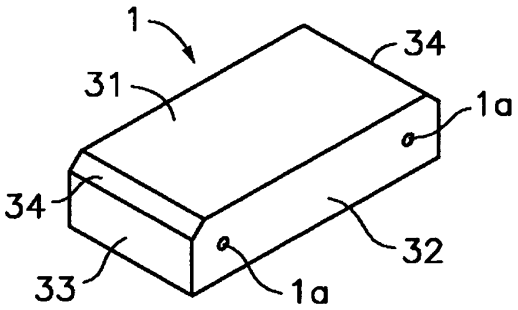

Fig.6

Fig.4

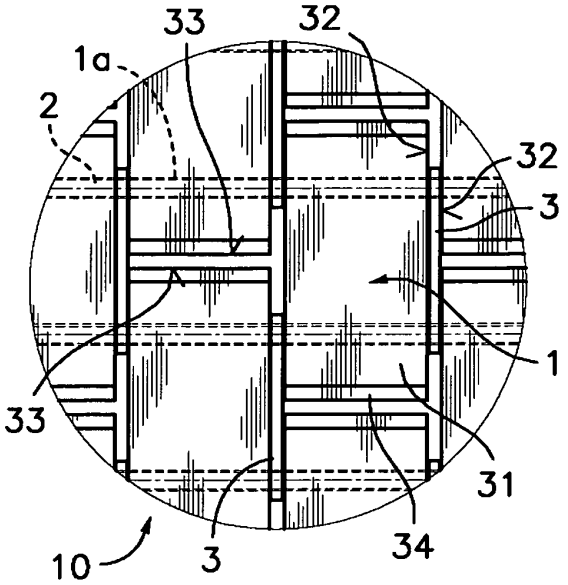

Fig.8

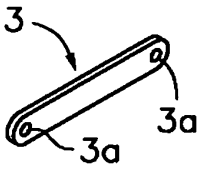

Fig.10

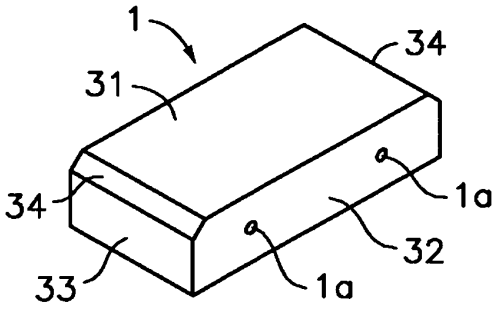

Fig.9

Fig.7

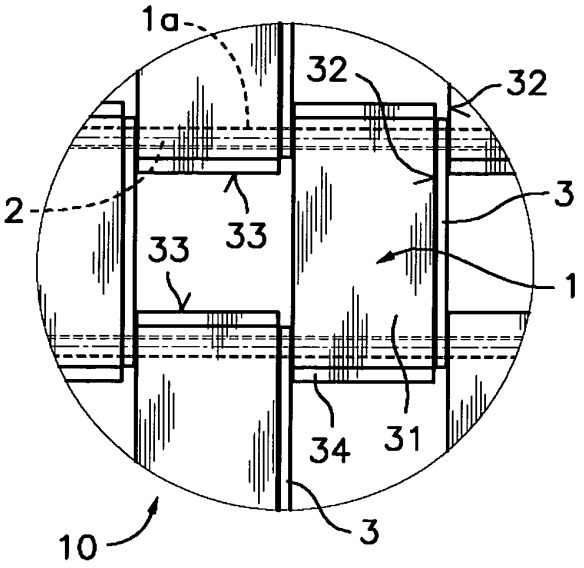

Fig. 12

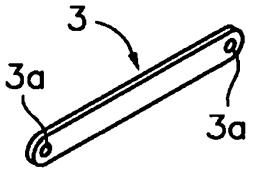

Fig. 14

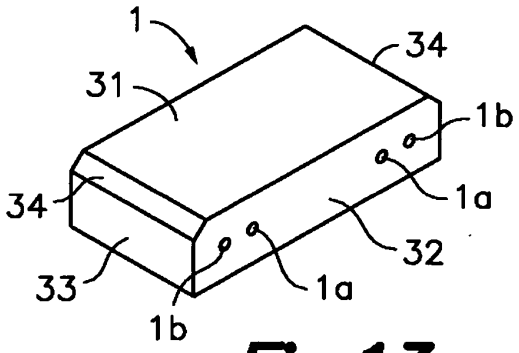

Fig. 13

Fig. 11

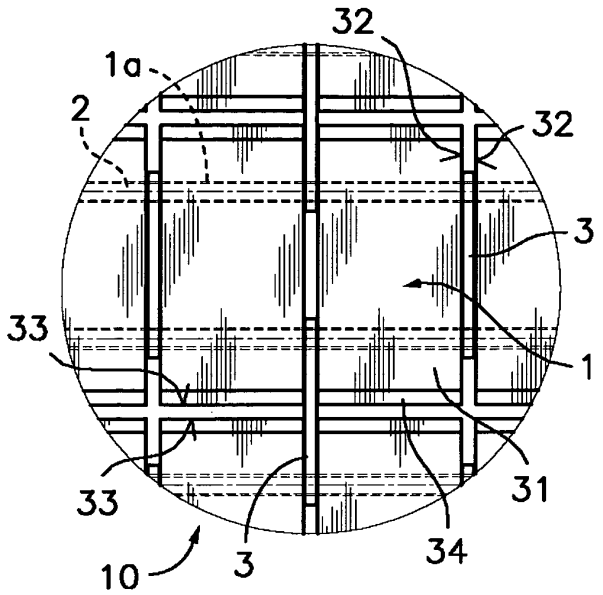

Fig. 16

Fig. 18

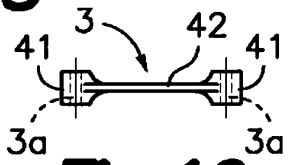

Fig. 19

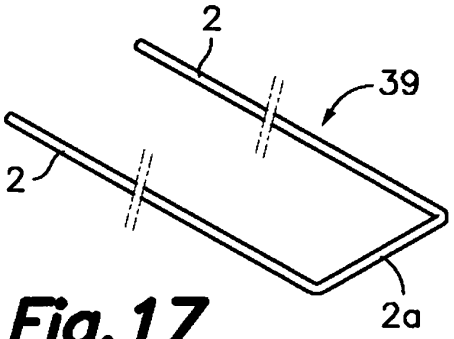

Fig. 17

Fig. 15

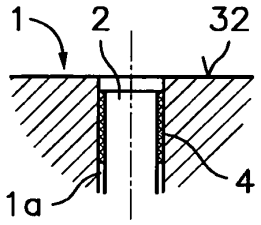

Fig.20

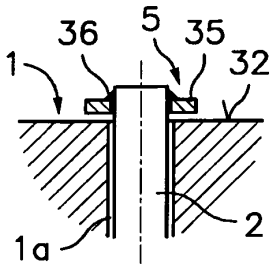

Fig.21

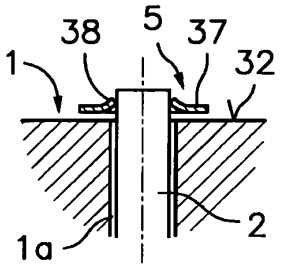

Fig.22

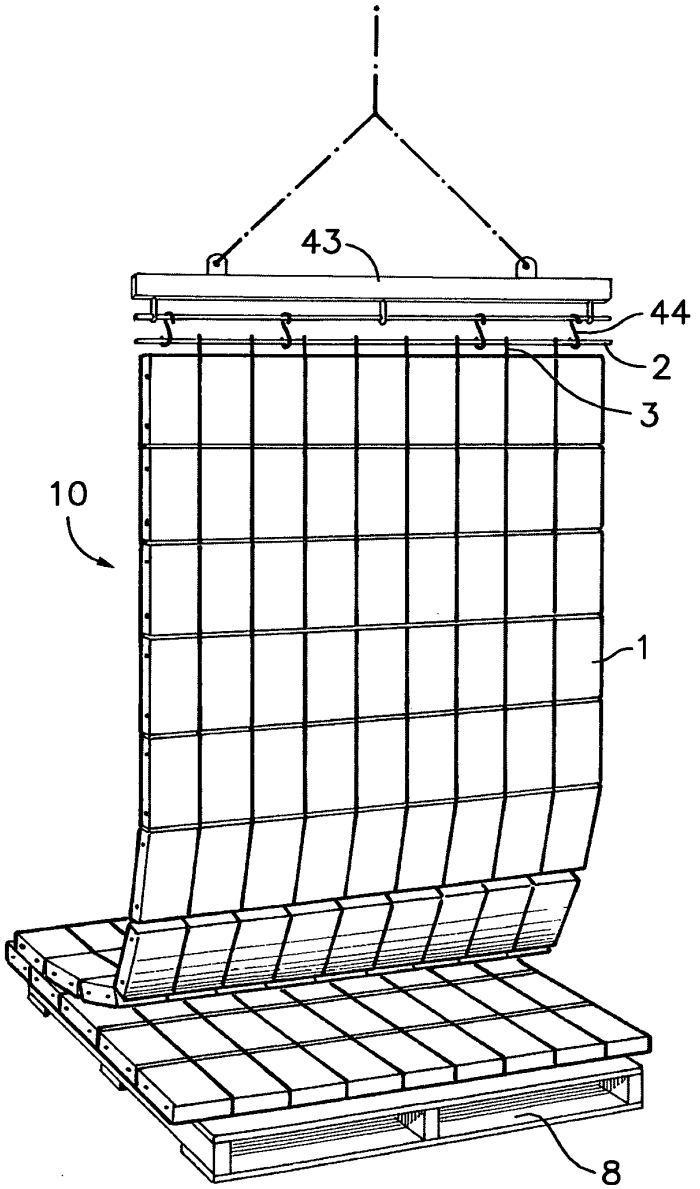

Fig.23

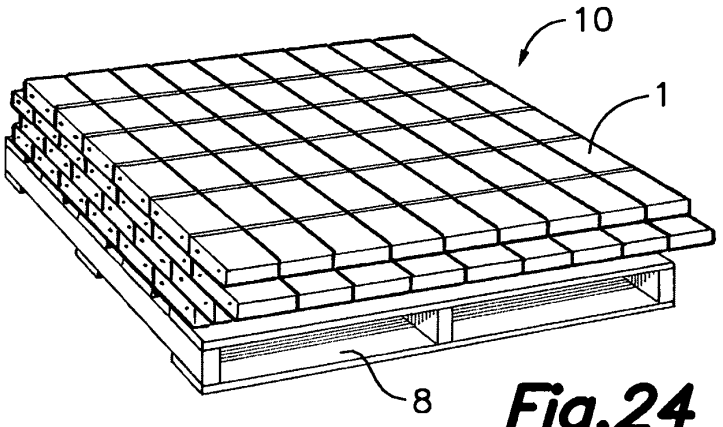

Fig.24

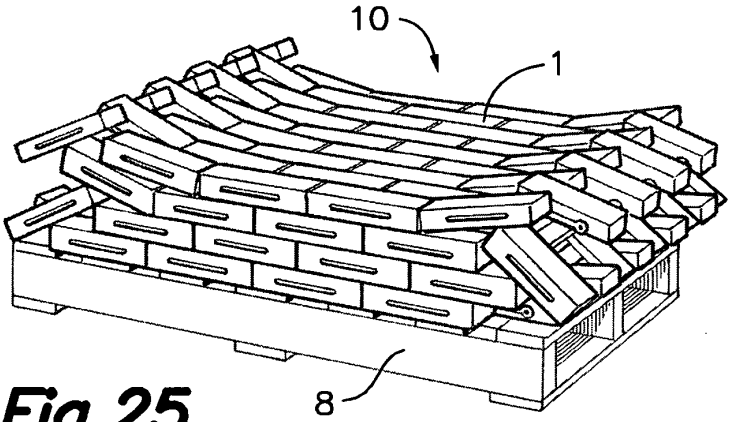

Fig.25

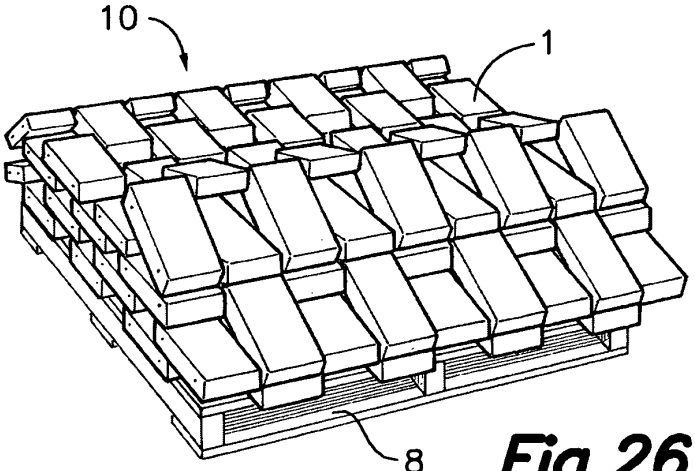

Fig.26

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2010/000439

A. CLASSIFICATION OF SUBJECT MATTER

E02B3/14 (2006.01)
E01C5/04 (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E02B, E04B, E01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4664552 A (SCHAAF CECIL) 12/05/1987, column 1, line 58 - column 2, line 19; column 2, lines 35 - 68; column 4, lines 1 - 8; claim 1, figures.	1, 3-6, 12
A	AU 594968 B2 (SOIL FILTERS AUSTRALIA PTY LTD) 22/03/1990, page 3, lines 7 - 16; page6, lines 18 - 29; figures.	1, 3-6
A	DE 3212411 A1 (BETON GANDLGRUBER GMBH ET AL.) 13/10/1983, abstract; figures.	1, 3-6
A	US 5622449 A (ESSAY JR ALBERT J) 22/04/1997, column 2, lines 4 - 19; figures.	1, 3-6
A	FR 1254131 A (ROSA ALDO) 17/02/1961, abstract; figures.	1

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Date of the actual completion of the international search	Date of mailing of the international search report
25/03/2011	**(09/05/2011)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer E. Balsera Porris Telephone No. 91 3493260

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2010/000439

C (continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of documents, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 1658495 B1 (LEHNEN WALTER) 30/09/1971, figures.	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/ES2010/000439

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
US5622449 A	22.04.1997	NONE	
US4664552 A	12.05.1987	CA1260721 A	26.09.1989
DE3212411 A	13.10.1983	NONE	
DE1658495 B	30.09.1971	NONE	
FR1254131 A	17.02.1961	NONE	
AU594968 B	22.03.1990	AU6153586 A	26.02.1987

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2008139008 A **[0002]**
- FR 2744471 **[0004]**