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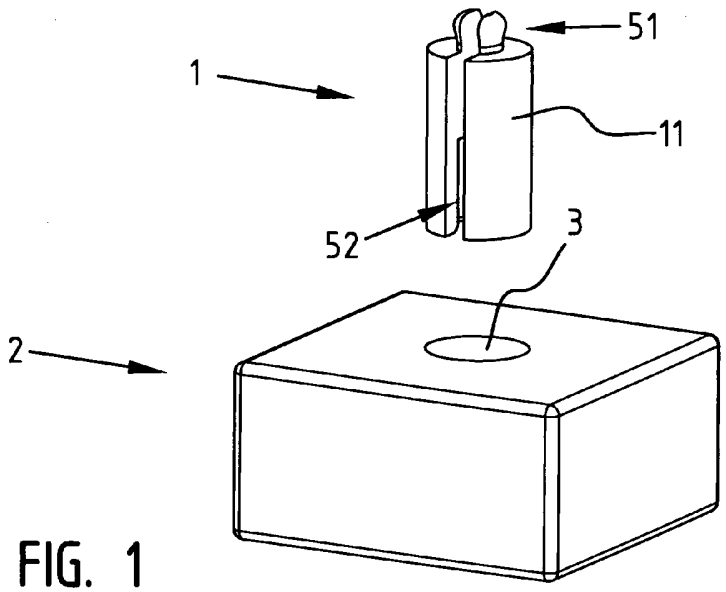

FIG. 1

(57) Abstract: A connecting element for building blocks is provided which comprises a main part which is adapted to be received in a complementary hole present in a building block, and which is adapted at both outer ends of the main part to be coupled, without the use of accessories, to a like connecting element by means of a first and a second coupling structure provided at these outer ends, wherein the first and the second coupling structures are adapted to be able to form a snap connection with respectively the second and the first coupling structures of a like connecting element. The connecting element may be provided with an external screw thread. Corresponding building bricks, annular elements of the nut type and a kit of building bricks are also set forth.

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CONNECTING ELEMENT FOR BUILDING BRICKS, BUILDING BRICK, NUTS AND KITS OF SUCH ELEMENTS

Description

The present invention relates to the field of construction elements such as building bricks, as for instance are found in toy articles of the building block type or construction type.

Background

Nowadays there are different types of toy building bricks and construction systems.

There are also different terms representing an elementary construction element, such as for instance the terms "(building or construction) brick", "(building or construction) block" and "(building or construction) element".

In the context of this description the terms "(building) brick" or "(building) block" are used to refer thereto. Unless otherwise stated or implicitly apparent to the skilled person, this "brick" does not have to have a specific shape. Different shapes can be used without departing from the present invention.

Many existing building bricks are based on the combining of building elements or bricks by means of a combination of a female and a male coupling structure, which are each usually arranged permanently on one of the surfaces of a corresponding building element and which can be clamped in respectively a complementary male or female coupling structure of a subsequent building element [for instance the classic LEGO™ building brick].

The male coupling structures protrude from the brick, which enables a good coupling/fixing to other building

elements, but which simultaneously limits the number of degrees of freedom in the combination of bricks.

The coupled constructions are often also difficult to remove from each other, this being particularly so with elements of relatively small dimensions and for small children.

There is often also a fixed orientation direction for the constructions built with such building elements; the male and female elements are situated on opposite surfaces of a building element so that a construction always ends at the top in male coupling structures, and at the bottom in female coupling structures, wherein top and bottom are in opposite directions.

These coupling structures can also be damaged, which results at the very least in a reduction in the functionality of the block and/or coupling structure; the strength of the coupling can decrease or be completely lost.

This also means that the use of determined materials is impossible or would result in inferior quality. In commercial kits of such building bricks elements are often also added which allow some measure of deviation from the "main direction", although these are usually present in relatively rather small numbers so that the intrinsic "deviation" options for commercially available construction kits is rather limited.

Other systems comprise holes in the building elements, optionally in combination with the coupling structures as described in the previous paragraph, and associated connecting rods which fit, clamp or snap into these holes. An example hereof are LEGO Technics™ kits. These connecting rods cannot however be directly coupled to each other, and accessories are required to realize such a coupling. This means a limitation in the possible combinations of building bricks and a reduction in degrees of freedom in the combining of building bricks.

The company Kiditec (www.kiditec.com) produces construction kits which comprise blocks provided with holes through which connecting elements can be arranged, which are adapted to be screwed directly into similar connecting elements and which can thus couple blocks to each other without further accessories. These connecting elements of the "bolt" type are provided with a small piece of screw thread on the outer end, away from the head, which does not run over the full length of the "bolt", and lie releasably in the opening. The connecting element must co-act at this outer end with a nut-like element to enable coupling/attachment to the block through which the connecting element runs; this nut is integrated with the head of a subsequent bolt, which has a hole with screw thread.

Many building systems are further also relatively complex, certainly for a child.

There is a current need for alternative building brick or construction systems which provide a solution to the limitations of the prior art and which are of simple design.

Summary of the invention

When terms such as "first", "second", "third" and so on are used, this does not necessarily mean that a successive or a chronological sequence must be assumed.

The term "comprising" must be interpreted such that it does not preclude any other elements or steps.

The prior art on which the preamble of claim 1 is based has a connecting element for building blocks, which comprises a main part which is adapted to be received in a complementary hole present in a building block, and which is adapted at both outer ends of the main part to be coupled, without the use of accessories, to a like connecting element

by means of a first and a second coupling structure provided at these outer ends.

Several drawbacks and features of the prior art connecting elements have already been described above in the background section.

The connecting structure described above under "Kiditec" technology further consists of a hard synthetic material and cannot be compressed by a child. Nor is it elastically compressible of deformable such that the connecting element can only be placed in a hole, the projection of which covers the cross-section of the connecting element according to the direction of the axis of the hole. In other words, the hole must therefore strictly be wider than the dimensions, in particular width or diameter, of the connecting element so that the latter can be inserted therein. This also means, among other things, that the connecting element cannot be clamped in the hole of the corresponding building brick, which also consists of hard synthetic material. The heads of the bolts moreover protrude above the surface of the building block.

It is an object of the present invention to provide an alternative which solves at least one or several of the above stated problems and is of simple design.

This is achieved by the characterizing features of claim 1.

A connecting element for building bricks is described, which comprises a main part which is adapted to be received in a complementary hole present in a building brick and which is adapted on both outer ends of the main part to be coupled, without the use of accessories, to a like connecting element by means of a first and a second coupling structure provided at these outer ends, wherein the first and the second coupling structures are adapted to be able to form a snap connection with respectively the second and the first coupling structures of a like connecting element.

The coupling to a like connecting element can be performed without the use of accessories, in other words two connecting elements according to the present invention can be directly coupled to each other; either by connecting the first coupling structure of the first element to the second coupling structure of the second element, or by connecting the second coupling structure of the first element to the first coupling structure of the second element respectively. Different snap connections can be used here.

It should be noted that a snap connection is a connection which can be associated with a snapping sound and/or snapping perception and/or snapping sensation, and that such a connection differs from a connection of the clamping type or the slide-in type, as is for instance the case in the classic Lego blocks. The snap connection can preferably be released again by a child, but is on the other hand sufficiently strong to make it possible to make constructions of building bricks which are coupled to these connecting elements. Examples of snap connections are for instance connections of the press-stud type. The first and the second coupling structures are preferably different. In embodiments of the present invention the first and the second coupling structures are complementary. One of the two coupling structures can thus be male, and one of the two coupling structures female. Further specific examples of snap connections and coupling structures will be set forth in the detailed description. In order to give an idea, reference can be made to a ball and a hole which together form a press-stud-like connection, as an example of such a pair of complementary coupling structures.

According to preferred embodiments of the present invention, the first connecting element is of the ball type and the second connecting element is of the hole type.

According to preferred embodiments of the present invention, the first and the second coupling structures can

together form a connection which is of the press-stud type. It should be noted that the coupling structures can also consist of more than one press-stud structure or more than one sub-snap system. Two coupling systems of the male type can for instance thus be arranged adjacently of each other at one outer end of the connecting element, while at the other outer end two coupling structures of the female type can be arranged which are aligned with the coupling structures of the male type. Other complementary structures which are adapted to form a snap connection can also be envisaged by the skilled person.

According to preferred embodiments of the present invention, the main part is essentially not elastically deformable in the axial direction, in other words, the connecting element is preferably not elastically deformable in the axial direction when it undergoes forces corresponding to the blow of a hammer delivered by a child hammering in a typical construction toy activity. This feature is particularly advantageous when hammering applications (applications in which the connecting element is driven into a corresponding opening with one or more blows on one outer end of the (first or second) element. This process can be deemed as being of substantially discontinuous nature since an (elastically or non-elastically) deformable connecting element could make this hammering activity impossible.

Instead of being hammered into the complementary hole of a building brick, an elastically deformable connecting element could thus rather bend or be compressed so that the connecting element cannot be arranged in the complementary hole, or not in sufficiently simple manner, while on the other hand a connecting element which is not elastically deformable but which is deformable can be deformed, change shape and hereby become incompatible with the complementary hole. The connecting element may further not be broken or

damaged by forces corresponding to, and in the order of magnitude of, an impact of a small hammer handled by a child.

According to preferred embodiments of the present invention, the main part is elastically deformable in the radial direction. This elastic deformation is preferably possible with forces in the order of the forces which a child can exert. These embodiments have the advantage that a connecting element can be arranged in a complementary hole by deforming elastically, and that this connecting element is then fixed in the hole owing to the elastic deformation. The main part can be manufactured for this purpose from a suitable plastic material such as a hard foam or soft plastic, wherein however the non-deformability of the main part in the axial direction is preferably maintained.

This can for instance take place by providing a soft synthetic material, or rather a hard foam, with an internal strengthening element such as a metal or hard plastic pin which is connected to the foam or semi-soft plastic and which is optionally also anchored in this material.

In an advantageous embodiment of the present invention the main part is mainly hollow so that it is formed by a thin wall which comprises at least one lateral incision extending over the full length of the main part. The incision can then begin for instance at the bottom of the main part and end at the top of the main part. This incision is preferably linear. This incision can also take on other forms, although the strength of the connecting element must not be affected substantially here, which would for instance be the case with a spiral incision which as it were spirals round the main part from the one outer end to the other. This latter example could result in a connecting element which is elastically deformable in the axial direction, which is rather undesirable for applications of the hammering type. The linear incision is preferably also

parallel to the central axis or axis of symmetry of the connecting element and/or the main part.

According to preferred embodiments, the at least one lateral incision continues over the full length of the element, in particular through the first and second coupling structures. These embodiments have the advantage that the coupling structures are also radially deformable, which results in an elegant embodiment of a snap system.

The coupling structures are preferably non-deformable in the longitudinal direction of the main part or along the direction of the axis of symmetry or axial axis of the main part. This under the influence of forces corresponding to the forces of a hammer blow delivered by a child on the connecting element with a typical toy hammer.

The main part, and accordingly substantially the connecting element also, is preferably cylindrical. It preferably comprises a smooth outer surface, for hammering applications, although it can also be provided with screw thread. This screw thread can then be used to fit into a corresponding screw thread of a building brick. This screw thread can also be engraved in a manner such that the connecting element can still be hammered into the complementary opening. The complementary opening can on the other hand also be provided with screw thread which is complementary to the screw thread on the connecting element in order to hold the connecting element sufficiently firmly in the opening. Also possible are other structures differing from the screw thread structure, but of the same type, allowing a connecting element to be screwed firmly into an opening of a building block. The screw thread-like structure on the inner side of a complementary hole of a building brick can for instance thus be provided with semi-ball-like protrusions which co-act with a screw thread on the connecting element.

It should be noted that the coupling structures can be arranged as separate elements on the main part or as part on the main part, which allows the coupling structures to consist of different materials than the main part or the rest of the main part. These embodiments however necessitate a more complex production process, and also raise concerns in respect of stability, long-term fixing, hammer resistance and so on, which are not present in connecting elements consisting of one material and essentially a single piece.

The coupling structure of the male type can be of the ball type or can form an O-like (omega-like) structure or take a similar form. The female coupling structure can be a structure which is complementary to this structure of the ball type, although it can be any structure which allows a snap connection to the coupling structure of the male type. A ball can thus be received as coupling structure in an opening of the other outer end of a like connecting element of adapted size and comprising a groove or circular edge, into which the ball snaps fixedly when it is placed in the female coupling structure. Other coupling mechanism structures resulting in snap systems can be applied by the skilled person in the context of the present invention.

According to embodiments of the present invention, the cylindrical main part is provided on its outer ends with screw thread which is arranged into the main part. This screw thread can be engraved in the outer wall of the main part such that the main part, and so the connecting element, allows hammering thereof into an opening in a building brick. This screw thread can be arranged on the connecting element, i.e. at both outer ends, it can for instance be one or two windings at each outer end of the connecting element, although the screw thread can also extend over the full length of the connecting element.

The connecting elements according to the present invention can be constructed from different materials. They

are preferably constructed from a suitable synthetic material (for instance polyethylene), plastic, a hard or soft foam material, hardboard, compressed fibre materials and so on, although other materials are not precluded. Since preferred embodiments of the present invention are related to toy applications, the materials are preferably compatible with the current safety standards for materials for toys.

The connecting elements according to embodiments of the present invention can be manufactured in different dimensions without losing their essential characteristics. A connecting element can thus have a length of for instance about 8 mm, 9 mm, 10 mm, 11 mm, 12 mm, although smaller or larger dimensions are likewise possible. The cross-section of a connecting element can for instance be about 5 mm, 6 mm, 7 mm, 8 mm, 9 mm, 10 mm, 11 mm, 12 mm, 13 mm, 14 mm, 15 mm, although smaller or larger dimensions are likewise possible.

According to embodiments of the present invention, the substantially cylindrical main part comprises a widening at one of the two outer ends. The widening can take the form of a nut-like structure described in other embodiments of the present invention.

In a second aspect of the present invention a building brick is shown which comprises at least one coupling structure which is adapted and arranged to be coupled to another building brick or coupling structure, wherein the coupling structure is situated at the outer end of a connecting element, the connecting element being arranged and secured removably in a hole in the building brick, and further according to embodiments of the present invention.

In a third aspect of the present invention a building brick is shown which comprises at least one substantially cylindrical hole which runs through the building brick, wherein the radius of the hole widens from a determined depth toward the outer surface of the building brick such

that there is a limited annular recess around the outer ends of a connecting element according to an embodiment of a first aspect of the present invention, if this connecting element were adapted to the hole, were arranged wholly in the hole and were to have a main part with a height equal to the length of the hole.

Preferred embodiments of a building brick according to the present invention further comprise at least one opening or elongate groove provided in its surface which is adapted to form a snap connection with a male coupling structure of the connecting element according to the first aspect of the present invention.

The building blocks according to embodiments of the present inventions are preferably constructed from wood or a suitable synthetic material, polyethylene, plastic, a hard or soft foam material, hardboard, compressed fibre materials and so on although, as can be appreciated by the skilled person, other materials are possible. The building blocks can be cast or blown, or manufactured via other techniques known to the skilled person, in accordance with the application.

In preferred embodiments the building blocks comprise wood or consist of wood.

In preferred embodiments of the present invention a combination of wood/plastic, wood/synthetic material or (synthetic material or plastic)/(synthetic material or plastic) is used for the building block and the connecting element respectively. In a set of building blocks different building blocks can consist of different materials, which are however preferably adapted to co-act with connecting elements all having the same composition or relevant features.

The building blocks according to embodiments of the present invention can be manufactured in different dimensions without losing their essential characteristics. A

building block can thus have a length of for instance about 5, 6, 7, 8, 9, 10 cm, a width of for instance about 6, 7, 8, 9, 10 cm and a height corresponding to the dimensions of the associated connecting elements of for instance 8 mm, 9 mm, 10 mm, 11 mm, 12 mm, although smaller or larger sizes are also possible for the different dimensions. The holes present in the building blocks can also have different dimensions which, when they are supplied in a set together with the associated connecting elements, correspond to the dimensions of these connecting elements.

In a fourth aspect of the present invention an annular element is described, with a form complementary to the annular recess in a brick as described in the third aspect of the present invention, and which is further provided with a coupling structure which is adapted to couple to the screw thread of a connecting element according to the first aspect of the present invention, wherein screw thread is present close to the outer ends of the connecting element when it is arranged in the annular recess. This annular element moreover preferably comprises a structure on the surface which is oriented outward when the annular element is arranged in said annular recess, which is adapted to interact with an elementary or modified screwdriver with a flat head or crosshead, or any other structure. The presence thus suffices of two aligned incisions on either side of the hole formed by the annular element adapted to receive a normal screwdriver with flat head for the purpose of rotating the nut, were it not the case that this nut is adapted to be placed at the end of a connecting element according to the present invention.

In a fifth aspect of the present invention a new type of screwdriver is therefore provided for use with the annular element according to the fourth aspect of the present invention. This screwdriver debouches in a fork structure with two teeth, each tooth ending in a flat head,

both flat heads being aligned and adapted to couple to an annular element according to the fourth aspect of the present invention.

In a sixth aspect of the present invention a kit of building bricks of the building brick type is provided, wherein each building brick has at least one hole of the same predefined form or diameter or cross-section, wherein the kit further comprises at least one connecting element according to an embodiment according to the first aspect of the present invention which is adapted to be received in the holes. This receiving can for instance take place by sliding, hammering or screwing of the connecting element into the holes.

In preferred embodiments of the sixth aspect of the present invention the dimensions of the building bricks and connecting elements present in such a kit are chosen in well-considered manner. The dimensions of the building blocks (which can for instance also take the form of "construction plates" or "construction panels", as well as other forms), can thus always correspond to or be whole multiples of a basic dimension. This provides the advantage that cube structures are or can be formed easily and in many ways. The connecting elements can therefore have a length corresponding to this basic dimension or a multiple thereof. In an embodiment of the present invention beam-like building blocks are for instance provided which have a length which is twice the width and/or a height corresponding to a third of the length. The connecting elements can for instance be three basic units long and can then for instance join together three (or two or four or another whole number) building blocks (for instance construction panels) which each have a thickness (or height) amounting to one basic unit. Each of these three construction panels can moreover fulfil a function of its own and/or for instance consist of a different material or have a different colour. Building

blocks can also have heights (or thicknesses) which amount for instance to a whole multiple of the basic unit, while the connecting elements are only a single basic unit long (or high).

According to a seventh aspect of the present invention, a data storage medium is described which comprises a program which, when run on a computer, is adapted to display a connecting element according to the first aspect of the present invention on a screen.

In a further aspect of the present invention building bricks are described which are adapted for use in combination with connecting elements according to embodiments of the invention. These building bricks are as any of the building bricks as already described above, comprise at least one transverse opening running through the building brick and comprise at least one fixing means. This fixing means is preferably adapted to ensure that two of such building bricks, which are arranged so that one of their respective transverse openings lies mutually in line and so that their predetermined respective surfaces are mutually adjacent, and which are mutually connected by means of a cylindrical connecting element (for instance constructed from connecting elements) arranged in the openings, cannot rotate relative to each other around the axis of symmetry of the openings.

These fixing means can consist of protruding edges or protrusions and complementary recesses in the respective surfaces of the two building bricks comprising transverse holes, which are provided to be mutually adjacent during building of a construction (illustrated in Fig. 47).

Further aspects of the present invention are described in the dependent claims. The features of the dependent claims, features of any of the dependent claims and any of the features of other dependent claims can be combined and

be deemed appropriate by the skilled person, and not only in the specific combinations as defined by the claims.

Description of illustrative examples and drawings

The above stated and other advantageous features and objects of the invention will become more apparent and the invention will be better understood as a result of the following detailed description when read in combination with the respective drawings.

The accompanying drawings are used to illustrate embodiments of the present invention.

Reference symbols are chosen such that they are the same for similar or the same elements or features in different figures or drawings.

The description of the aspects of the present invention is given by means of specific embodiments and with reference to, but not limited to, specific drawings. The shown figures are only schematic and must be deemed non-limitative. Determined elements or features can for instance be shown out of proportion or scale in relation to other elements.

Figures 1-16 show a connecting element according to an embodiment of the present invention. Connecting element (1) comprises a main part (11), a first coupling structure (51) and a second coupling structure (52), which preferably differ and are more preferably complementary. In this embodiment a male coupling structure of the ball type is situated at the top of the connecting element while a recess, the female coupling structure, is provided at the bottom in the main part, and so in the connecting element, to which the male coupling structure can couple. Figures 1-3 show a building brick (2) which comprises a hole (3) which is adapted to receive connecting element (1). Connecting element (1) can be placed in opening (3) by simply sliding therein, by hammering or hammering applications or by being

screwed therein if a screw thread or similar structures are provided on the outer wall of the main part of the connecting element and the inner wall of the hole in the building brick.

Figures 6 and 7 illustrate a further embodiment of the present invention. A connecting element (1) similar to the connecting element of figures 4 and 5 is shown, which comprises a main part (11), a male coupling structure (51) placed at the top of the main element and a female coupling structure (52) at the bottom of the main element or at the bottom of the connecting element. According to this embodiment the main part of the connecting element is substantially hollow such that material and weight can be saved and such that the connecting element can undergo some plastic deformation in the radial direction at the bottom of the opening which corresponds to the female coupling structure, a circular groove (521) is preferably provided which is adapted to receive the male coupling structure of a like connecting element by means of a snap connection. Figures 8, 9 and 10 show at the bottom different embodiments of snap connections which can be used in the embodiments of the present invention. Figure 8 shows a single snap connection between a single male coupling structure and a female coupling structure such as for instance exists for a press-stud connection. Shown at bottom right is an alternative snap connection, wherein a plurality of aligned male and female coupling structures are used to realize the snap connection. Other embodiments are not precluded, as a skilled person will appreciate.

Figures 5 and 7 illustrate how a connecting element according to the present invention can be coupled to a like connecting element by having the respective first coupling structure, which is arranged on the first outer end of the main part of a first element, make a snap connection with a respective second coupling structure arranged on the other

outer end of a second element. In figure 5 the male coupling structure is preferably elastically deformable in the radial direction. The female coupling structure is preferably also elastically deformable in the radial direction. Figure 7 shows a similar embodiment, wherein the connecting element is largely hollowed out, and so substantially hollow, and wherein an annular groove, into which the respective male coupling structure can snap fixedly, is provided inside the wall.

It should be noted that there are connecting elements according to embodiments of the present invention which are not elastically deformable in the radial direction, and that there are also connecting elements which are elastically deformable in the radial direction of the connecting element. The axial direction of the connecting element is understood to mean the axis of symmetry of the main part or of the whole connecting element. The radial direction is then the direction perpendicularly of the axial direction of the connecting element. Figure 12 shows a connecting element according to the present invention which is manufactured from a material which can withstand a hammer blow of a toy hammer delivered by for instance a child. This connecting element is non-deformable and neither elastic nor inelastic in the axial direction, but is provided with a lateral incision (7) extending along the length of the main part. The connecting element is further also hollow on the inside, such that it can be compressed or is elastically deformable in the radial direction. An advantage of this embodiment is that materials can be used which are not deformable per se in the radial direction but which can withstand a hammer blow delivered by a child with a toy hammer, while the connecting element is still elastically deformable in radial direction and can hereby be placed in the opening or hole of a corresponding building brick. Coupling structures as described above are arranged on the connecting element.

Figure 13 shows a preferred embodiment of the present invention in which the connecting element comprises a lateral incision extending over the full length of the (substantially hollow) element, in particular over the first (51) and second (52) coupling structures. This embodiment has the further advantage that not only the main part of the connecting element is elastically deformable in the radial direction, and can thereby be placed in a hole in a corresponding building brick, but that coupling structures (51, 52) are also radially and elastically deformable because of this central incision, which simplifies the creation of a snap system or results in a specific embodiment of a snap system for use in combination with the present invention.

Figure 11 shows a further embodiment of the present invention in which only the male coupling structure is provided with a lateral incision 7, while the main part comprises no such incision. This embodiment can occur when the main part can for instance consist of an elastically deformable material, and wherein this main part is connected to a male coupling structure consisting of a different material which, being without incision, is for instance not per se elastically deformable in the radial direction.

Figures 17-23 show different cross-sections, only by way of illustration, and certainly not in any limitative sense, of connecting elements according to the present invention or the corresponding holes in corresponding building bricks. Various other cross-sections of connecting element and/or holes can be envisaged, as will be appreciated by a skilled person.

Figures 15 and 16 show further embodiments of the present invention; a connecting element which is hollow on the inside and which comprises a lateral incision extending over the full length of the connecting element, in particular the male and female, or the first and the second,

coupling structures. Screw thread (91) can be arranged along the side of the first coupling structure, and screw thread (92) can be arranged on the side of the second coupling structure. In alternative embodiments the screw thread (9) can also run all the way from the one outer end of the main part to the other outer end of the main part. It may be noted that the term screw thread is also understood to mean similar structures, being structures which enable a coupling of two elements, in particular building brick and connecting element, by means of a screwing movement. Other such structures can for instance be structures made up of semi-balls situated at suitable locations of the connecting element and adapted to be coupled to a screw thread on a corresponding building brick. Or vice versa, semi-ball structures can be arranged on the inner wall of a hole through a building brick at suitable locations such that they are adapted to receive the screw thread of a connecting element provided therewith by means of a screwing movement of the element. In preferred embodiments the screw thread is engraved in the side wall of the main part of the connecting element such that the "enveloping" side wall is still straight and the connecting element can be used for hammering applications as a result, wherein the connecting element can be knocked by hammer blows into a hole in a corresponding building brick. The single or multiple provisions of screw thread have the advantage that new fixing systems for the connecting element according to the present invention can be developed, as will be described in further detail. This can be particularly interesting when the connecting element is arranged in the hole in a corresponding building brick without any clamping relation between the hole (the building brick) and the connecting element, so where the connecting element simply has to be pushed into the hole of the building brick and comprises no intrinsic fixation relative to the building brick. It should

be noted that this screw thread can also be present in embodiments in which the connecting element does remain fixed by means of clamping in the opening of a corresponding building brick when the screw thread is engraved into the connecting element.

In figure 14 a further embodiment of the present invention is described in which the connecting element comprises a main part which comprises a female coupling structure at the bottom and is further provided at the top with a male coupling structure, and in which the main part is essentially cylindrical, further provided with annular flexible elements lying at a determined angle (for instance perpendicularly) on the side wall. These elements can produce a virtually enlarging effect for the connecting element in the sense that a connecting element, which without flaps would slide through the corresponding opening, can only be clamped fixedly in these same openings due to the presence of such flaps, and as a result can be used for hammering applications.

Figures 1-3 for instance illustrate the combination of a connecting element (1) with a complementary building brick (2). It should be noted that, in the description of the different embodiments of the present invention, only one connecting element suffices for the purpose of filling a full depth of a hole in a corresponding building brick, but that a plurality of connecting elements can be combined to bridge the depth of a hole in a corresponding building brick, as will also be described below (see figures 41-46). Three connecting elements for instance can thus be combined in order to reach the full height of the hole. Conversely, corresponding building bricks can be provided which correspond to a fraction of the length of the connecting elements. There can therefore be for instance two, three or four plate-like elements (building bricks) which can be

coupled per two, three, four around one connecting element according to the present invention.

Figure 24 shows a further embodiment of the present invention in which a connecting element as described in figure 15 or 16 is arranged at the top in a corresponding building brick which is adapted to have, after insertion of the connecting element, an annular groove (10) in its surface which corresponds to at least a part of the screw thread of the connecting element (typically one, two, or three windings), this both at the top and at the bottom of the hole. This groove can have the further advantage that the connecting elements are more easily removable from the building brick in the case of a clamped connecting element. This also applies to any type of connecting element of the hammering type according to embodiments of the present invention. The groove can comprise a flat incision or a curved one (or, in other words, be partially formed by the flat or curved incision; see for instance figures 24, 25B, 26B).

The groove can also take a form which is complementary to the form of a flat nut of constant thickness and round side surface (see for instance figures 25A and 26A).

The groove can have a width, measured along the surface of the building brick, of for instance more than 1 mm, more than 2 mm, more than 3 mm. Such a typical width can preferably amount to 4 or 5 mm, although other greater or smaller values are also possible.

The (maximum, in the case of for instance figures 24, 25B, 26B) depth of the groove can for instance be 1 mm, 2 mm, 3 mm, 4 mm, 5 mm, although smaller or greater values are also possible, as long as the (maximum) depth amounts to no more than half the thickness of the building block.

Figures 25A, 25B, 26A and 26B illustrate further embodiments of the present invention, preferably for use in combination with building bricks with groove around the

holes as described for figure 24. In these embodiments connecting element (1) and nut (13) of figure 24 are as it were integrated at one of the two outer ends of the connecting element. In the embodiment shown in figures 25A and 25B this structure of the nut type is integrated at the female outer end of the connecting element, in figures 26A and 26B at the female outer end.

The connecting elements illustrated in figures 25A and 25B comprise a main part which is substantially cylindrical but which further has a widening diameter at the male outer end in order to thus form an "integrated nut"-like structure, wherein this "integrated nut"-like structure has a form corresponding to the forms described for the "nuts" of the other embodiments.

The connecting elements illustrated in figures 26A and 26B comprise a main part which is substantially cylindrical but which further has a widening diameter at the female outer end in order to thus form an "integrated nut"-like structure, wherein this "integrated nut"-like structure has a form corresponding to the forms described for the "nuts" of the other embodiments.

Figure 28 shows an analogous embodiment in which the annular groove (10) in the brick around the outer ends of the connecting element arranged therein rather has a round cavity complementary to a flat nut, and a constant thickness. In alternative embodiments the screw thread can run over the whole outer wall of the connecting element.

According to embodiments of the present invention (not shown), there is arranged instead of screw thread a similar structure of the screw thread type, consisting of a number of semi-balls or other protrusions on the outer surface of the connecting element which are arranged at suitable locations so as to thus enable a screw connection to be formed with a screw thread arranged on the inner wall of a hole of a corresponding building brick.

The annular element (13), with a form complementary to the annular recess, is described in figures 24 and 28 and can be further provided with a coupling structure adapted to couple to the screw thread of a connecting element according to the present invention when this latter is arranged in the annular recess present in the building brick, around the outer end of the connecting element arranged therein. On its surface intended to be directed toward the connecting element this "nut", as the annular element can be referred to, comprises a screw thread (14) or a similar structure (15), such as the semi-balls arranged on this surface. As a result these "nuts" can be tightened onto the outer ends of the connecting element according to embodiments of the present invention, as shown in figures 24 and 28.

It should be noted that the connecting element preferably comprises a lateral incision which runs over the full length of the connecting element such that the connecting element is elastically deformable in radial direction and can be hammered into the opening, wherein the annular recess around the outer ends on the edge of the openings in a building brick can help to guide the connecting element to the hole. Once the connecting element has been placed in the opening, either by hammering or by sliding in or screwing in, the "nuts" or annular elements can be arranged on these outer ends in the complementary recesses by being screwed fixedly onto the outer ends of the connecting element. In this way the connecting element is placed more firmly in the building brick for variants of the present invention in which this could still be necessary or could involve a useful improvement of the fixation of the connecting element in the building brick. When the connecting element has been arranged in an opening (and comprises for instance no lateral incision, rather is non-deformable in the radial direction) and is simply inserted into opening (3) of brick (2), further fixation will thus be

necessary by means of this embodiment of the present invention.

It may be noted that the "nut" further comprises a coupling structure which is arranged on the front of the "nut" (being the surface of the "nut" which is exposed on the surface of the building brick when placed in the groove of the brick) which is adapted to co-act with a tool according to embodiments of the present invention which are elucidated hereinbelow. One or more grooves can for instance thus be provided in this surface, which are aligned or directed toward the central axis of the "nut". Two aligned grooves suffice (flat head) to enable a good screwing movement with the "nut" to thus tighten the nut onto the connecting element, although a plurality of grooves, such as four grooves aligned two by two at an angle of 90□ (a crosshead), or other configurations of grooves can be envisaged, as will be appreciated by a skilled person.

Figure 31 shows a basic structure of building bricks and connecting elements according to embodiments of the present invention. Advantages of the present invention can be identified here. The fact that connecting elements, which as it were form removable studs for a building brick, are removable or can be selectively arranged allows multiple degrees of freedom of construction; for instance a second brick placed on a first brick by means of a snap connection could rotate around this snap connection and could form connections with angles between building bricks other than 0□ and 90□, as is often the case in prior art construction kits. Since the connecting structures as it were form removable studs in a building brick, it is further possible to also orient these connecting structures in both directions by having for instance the male coupling structure protrude in a determined direction and sense in one hole and by arranging the male coupling structure in an adjacent hole in the same direction but in different sense.

Openings (3) can further also be provided in different walls of building brick (2). The building bricks can take on different shapes, volumes, topologies. What is important is that at least one hole is arranged in such building bricks which is adapted to receive a connecting element according to embodiments of the present invention. Examples of such building bricks are shown in figures 32-37, although these must not be deemed as limitative. It should be noted that different building bricks have surfaces which can be used in all orientations, or that holes can be arranged in each surface of a building brick, which means that a wide range of degrees of freedom becomes available for structures built up with a basic construction kit, this in contrast to determined prior art.

Figures 32 and 33 show building bricks according to embodiments of the present invention. The building brick comprises at least one opening or an elongate groove (16) in its surface, which is adapted to form a snap connection with a male coupling structure of the connecting element according to the present invention. Figure 32 shows a building brick comprising an elongate groove in which the male coupling structure of an annular element can be placed by means of a snap connection. Figure 33 shows another building brick which comprises openings (3) and which further comprises an opening (17) of the female type, adapted to receive the male coupling structure of a connecting element according to the present invention.

Figures 29 and 30 illustrate further embodiments of the present invention. In figure 29 a connecting element (1) is arranged in a building brick (2) by means of a screw thread inside the brick and on the wall of the connecting element. In other embodiments, as shown in figure 30, the building brick (for instance brick shape, ball shape and so on) can be hollow on the inside and screw thread (or any equivalent structure) can be provided in the wall of this building

brick such that the connecting element, which is provided with screw thread at the correct locations, close to its outer ends or along its full length, can be screwed into these walls and can be fixed in these walls.

Figures 38-40 show an application of embodiments according to the present invention. A toy representing a duck is here constructed from three building bricks (2, 2', 2") which are mutually connected by means of connecting elements according to embodiments of the present invention (1, 1', 1").

Figure 41 illustrates how a plurality of connecting elements (1) can be combined in order to span the full depth of a hole in a building brick (2). Conversely, figure 42 illustrates how a plurality of bricks (2, 2', 2") can also be combined with only one connecting element according to embodiments of the present invention. This is developed further in figures 43-46. In these figures two connecting elements according to the present invention are combined to span the full depth of the hole in brick (2), wherein the brick further comprises the annular recess around the inserted connecting elements in figures 44-46. Figure 46 comprises a pair of connecting elements which are each provided with screw thread close to each of its outer ends. Figures 43 and 44 show the same configuration, wherein the screw thread or similar structure is arranged over the full length of each of the two connecting elements which together fill the hole through the brick. It should be noted that a combination of connecting elements used to fill the thickness of a brick or the height of a hole through a brick can also be arranged therein by means of hammering, a screwing action or simply by sliding into a sufficiently large opening, as is explained for other embodiments of the present invention. Figure 41 illustrates how a plurality of connecting elements can also be used to fill one hole. It may be noted that in commercial kits connecting elements are

preferably used of a single predefined dimension, which has a fixed relation to the dimensions of the building bricks also supplied.

Figure 28 shows a tool which can be used in combination with embodiments of the present invention in which a "nut" is used to further secure the connecting structure in an opening of the corresponding building brick. This tool can typically comprise a handle and a shaft, and is of the screwdriver type. The shaft is however of the fork type, wherein two teeth are preferably present which each debouch at a flat head, and wherein both flat heads are aligned, corresponding to grooves in the corresponding surface of the "nut". This makes it possible to tighten the "nut" without being impeded by the central presence of the connecting element.

In the description of determined embodiments according to the present invention different features are sometimes grouped in a single embodiment, figure or description thereof, with the object of contributing toward the understanding of one or more of the different inventive steps. This may not be interpreted as if all features of the group are necessarily present in order to solve a specific problem. Inventive aspects are not to be found in all features of such group features present in the description of a specific embodiment.

Fig. 47 illustrates a further aspect of the present inventions. A for instance substantially cube-shaped building brick 21, which comprises a transverse hole 211 which is for instance perpendicular to and placed centrally on two surfaces 214, 215 of the cube, can for instance thus further comprise, on the first surface corresponding to the one outer end of the transverse hole, an elongate groove 300 having a cross-section of the arcuate type. The groove can for instance take the form of a cylinder cut in half in the longitudinal direction. This groove can be interrupted by

the transverse hole and can run on either side of the transverse hole. The groove can preferably divide the respective surface of the cube into two equal parts.

On the second surface corresponding to the second outer end of the transverse hole an elongate edge 301 can for instance protrude which is complementary to a groove as stated above, so that the groove and the edge could fit into each other.

Such grooves and edges can of course be arranged on optionally randomly determined surfaces of random building bricks.

When two building bricks are placed against each other and connected by means of a substantially cylindrical connecting element, the groove and the protruding edge can fit into each other so that neither building brick can rotate relative to each other around the axis of symmetry of the transverse holes or along the axis of symmetry of the substantially cylindrical connecting element.

While some embodiments described herein comprise some but not other features included in other embodiments, combinations or features of different embodiments are intended to lie within the scope of the invention and to form different embodiments, as would be understood by a skilled person.

While the principles of the invention have been described above in respect of specific embodiments, it must be clearly understood that this description is given only by way of example and is not limitative to the scope of protection defined by the appended claims.

CLAIMS

1. A connecting element for building blocks, which comprises a main part which is adapted to be received in a complementary hole present in a building block, and which is adapted at both outer ends of the main part to be coupled, without the use of accessories, to a like connecting element by means of a first and a second coupling structure provided at these outer ends, wherein the first and the second coupling structures are adapted to be able to form a snap connection with respectively the second and the first coupling structures of a like connecting element, wherein the main part is elastically deformable in the radial direction, the main part is substantially hollow so that it is formed by a thin wall which further comprises at least one lateral incision extending over the full length of the main part, and wherein the at least one lateral incision continues over the full length of the element, in particular through the first and second coupling structures.

2. A connecting element as claimed in claim 1, wherein the first and second coupling structures are different.

3. A connecting element as claimed in claim 2, wherein the first and second coupling structures are complementary.

4. A connecting element as claimed in claim 3, wherein the first connecting element is of the ball type and the second connecting element is of the hole type.

5. A connecting element as claimed in any of the foregoing claims, wherein the first and the second coupling structures can together form a connection which is of the press-stud type.

6. A connecting element as claimed in any of the foregoing claims, wherein the main part is essentially not elastically deformable in the axial direction.

7. A connecting element as claimed in any of the foregoing claims, **characterized in that** the coupling structures are non-deformable in the longitudinal direction of the main part.

8. A connecting element as claimed in any of the foregoing claims, with a main part which is cylindrical.

9. A connecting element as claimed in claim 8, wherein the cylindrical main part is provided on its outer parts with screw thread which is arranged into the main part.

10. A connecting element as claimed in claims 1-7, wherein the main part is substantially cylindrical but widens at one of the two outer ends close to this outer end.

11. A building brick which comprises at least one coupling structure which is adapted and arranged to be coupled to another building brick or coupling structure, **characterized in that** the coupling structure is situated at the outer end of a connecting element, the connecting element being arranged and secured removably in a hole in the building brick, and further as claimed in any of the claims 1-10.

12. A building brick which comprises at least one substantially cylindrical hole which runs through the building brick, **characterized in that** the radius of the hole widens from a determined depth toward the outer surface of the building brick such that there is a limited annular recess around the outer ends of a connecting element as claimed in claim 9 if this latter were adapted to the hole,

were arranged wholly in the hole and were to have a main part with a height equal to the length of the hole.

13. A building brick as claimed in claim 11 or 12, further comprising at least one opening or elongate groove in its surface which is adapted to form a snap connection with a first or second coupling structure of the connecting element according to any of the claims 1-10.

14. An annular element with a form complementary to the annular recess of claim 12, and which is further provided with a coupling structure which is adapted to couple to the screw thread of a connecting element according to claim 9 when it is arranged in the limited annular recess.

15. A kit of building bricks of the building block type, wherein each building brick has at least one hole of the same form, **characterized in that** the kit further comprises at least one connecting element as claimed in any of the claims 1-10 which is adapted to be received and clamped in the holes.

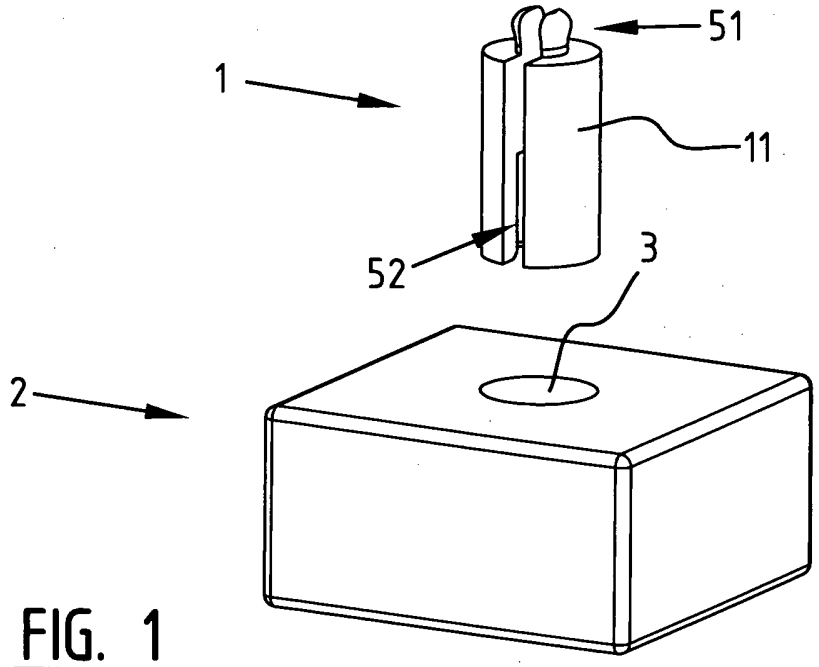

FIG. 1

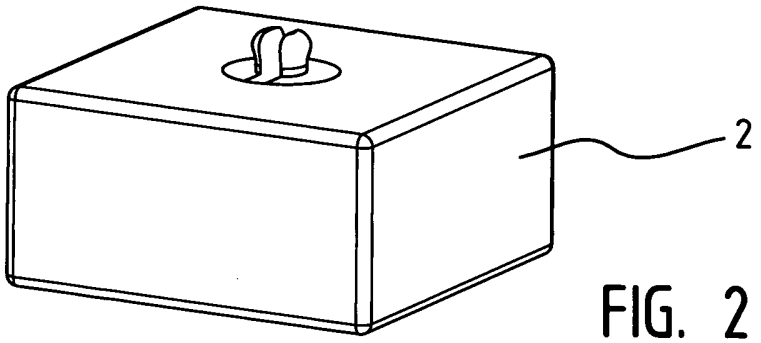

FIG. 2

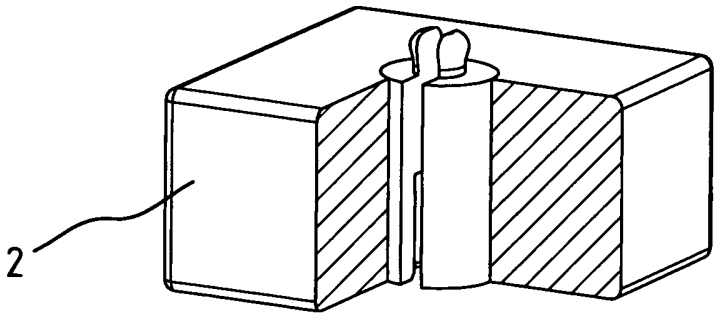

FIG. 3

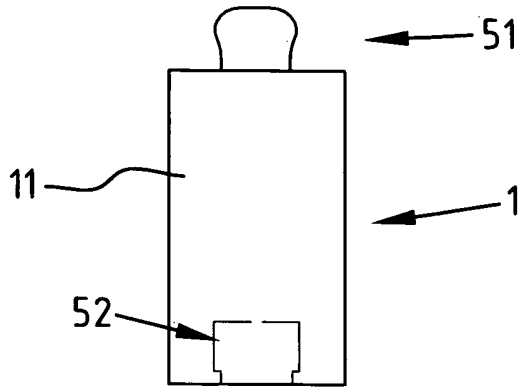

FIG. 4

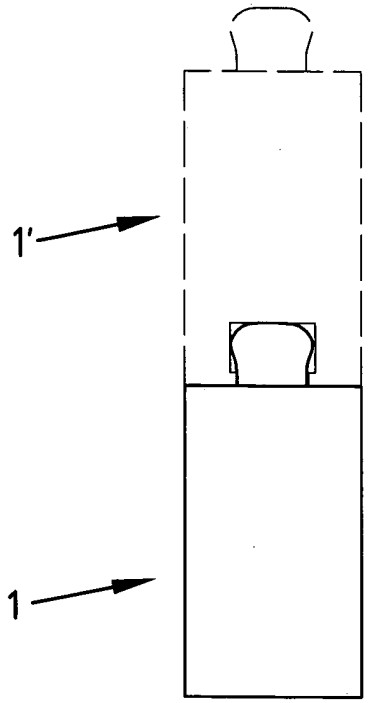

FIG. 5

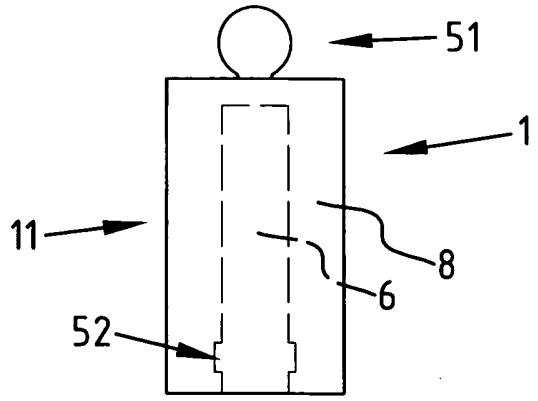

FIG. 6

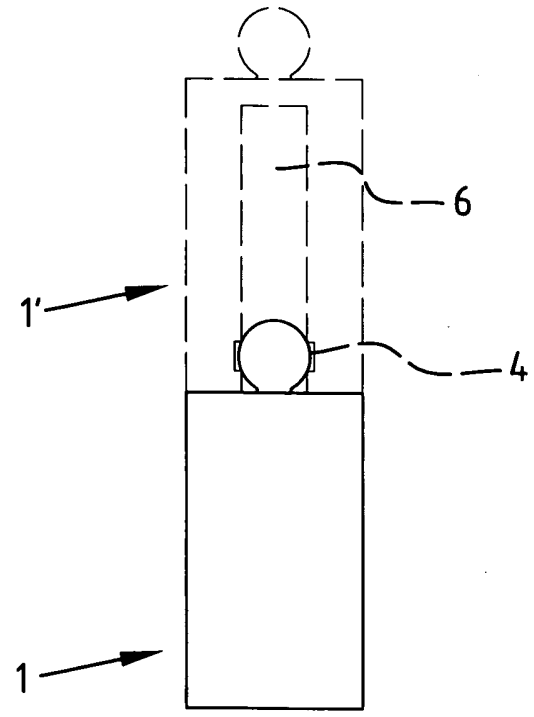

FIG. 7

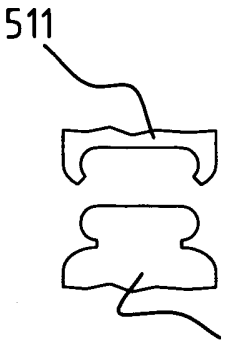

FIG. 8

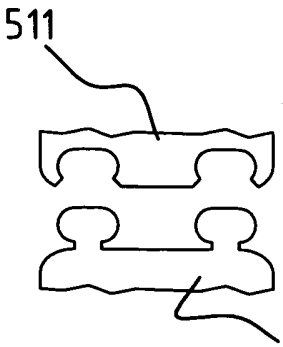

FIG. 9

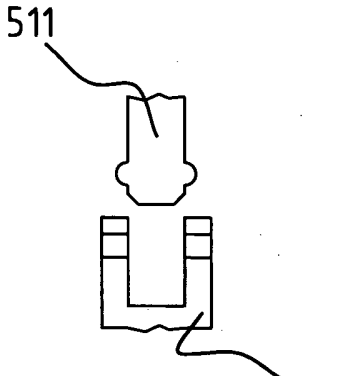

FIG. 10

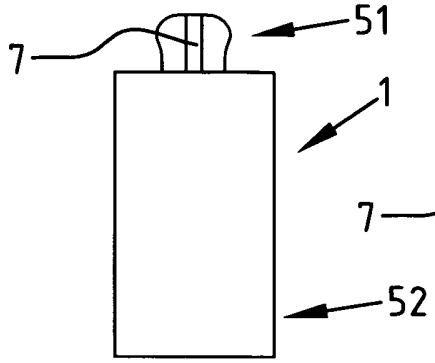

FIG. 11

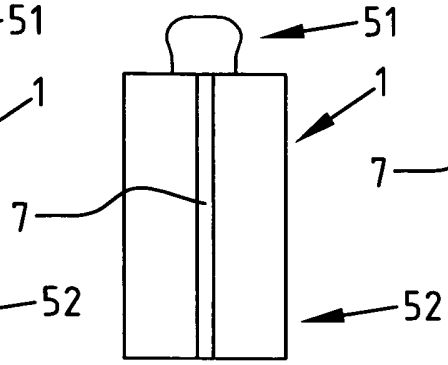

FIG. 12

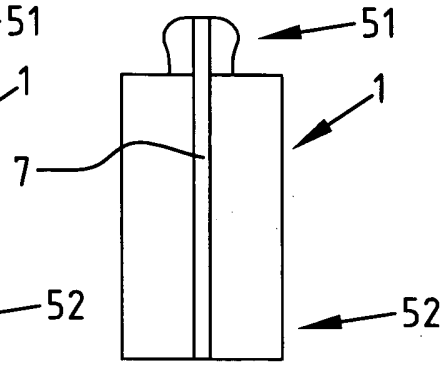

FIG. 13

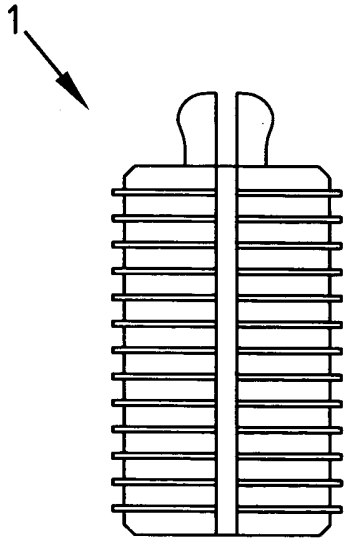

FIG. 14

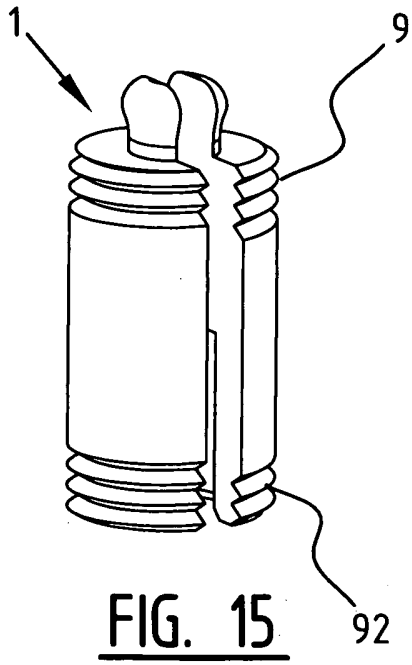

FIG. 15

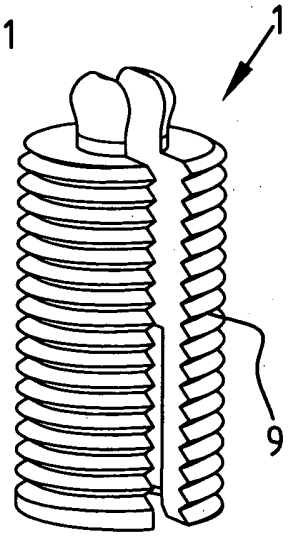

FIG. 16

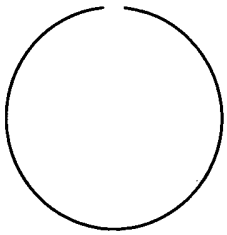

FIG. 17

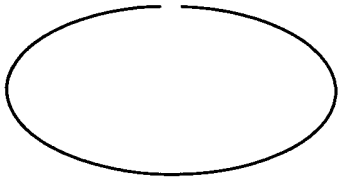

FIG. 18

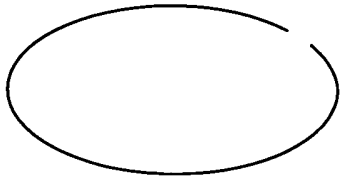

FIG. 19

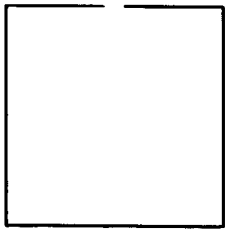

FIG. 20

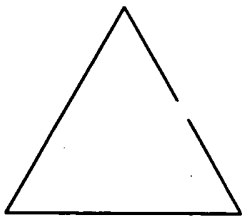

FIG. 21

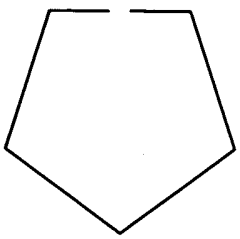

FIG. 22

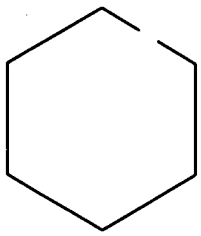

FIG. 23

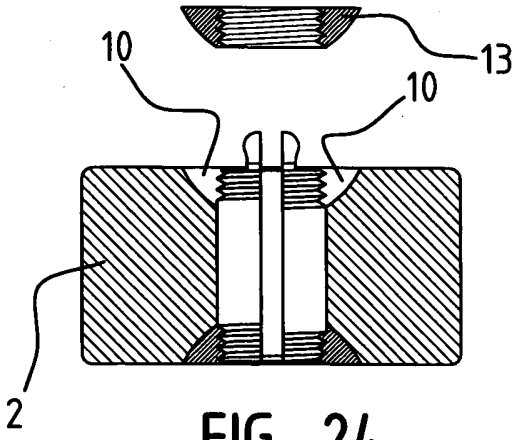

FIG. 24

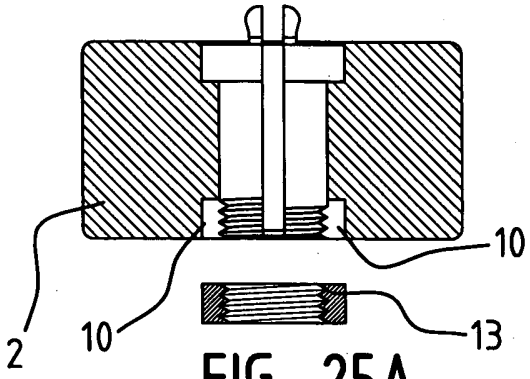

FIG. 25A

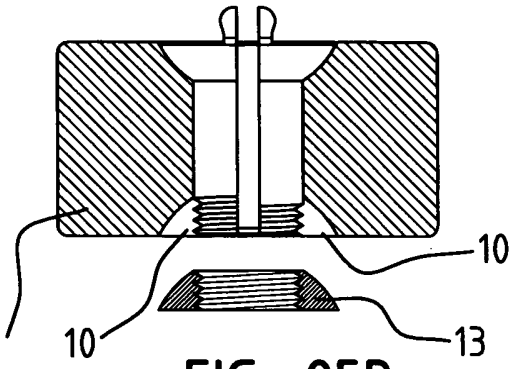

FIG. 25B

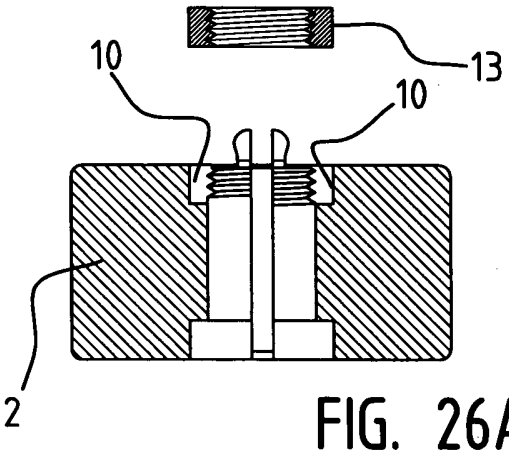

FIG. 26A

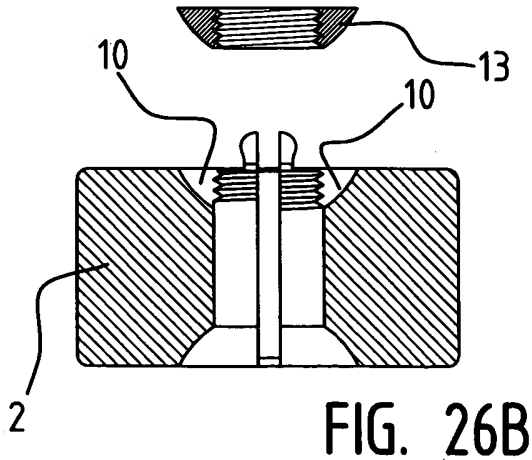

FIG. 26B

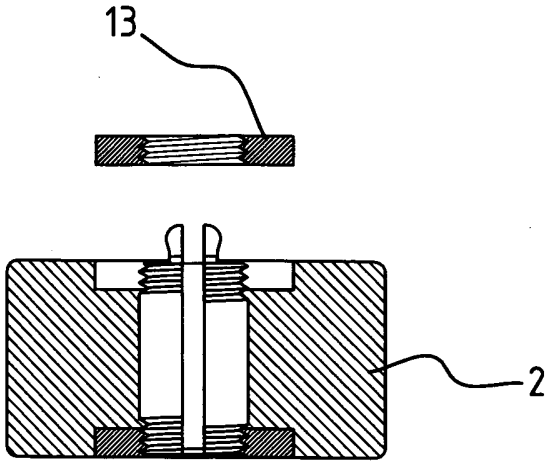

FIG. 27

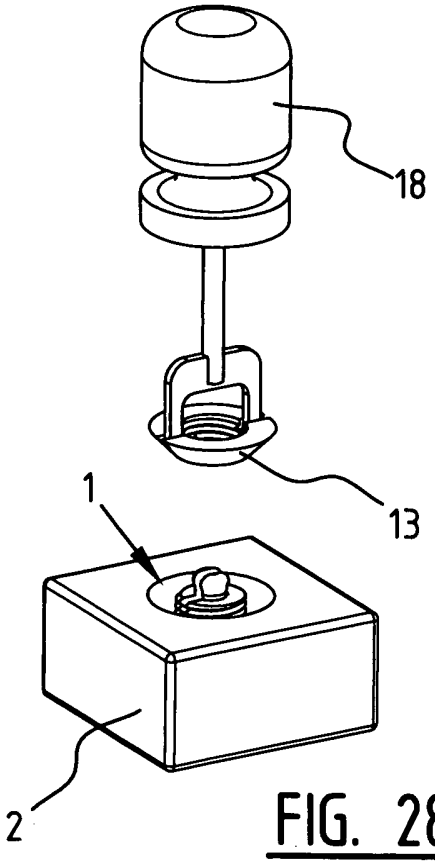

FIG. 28

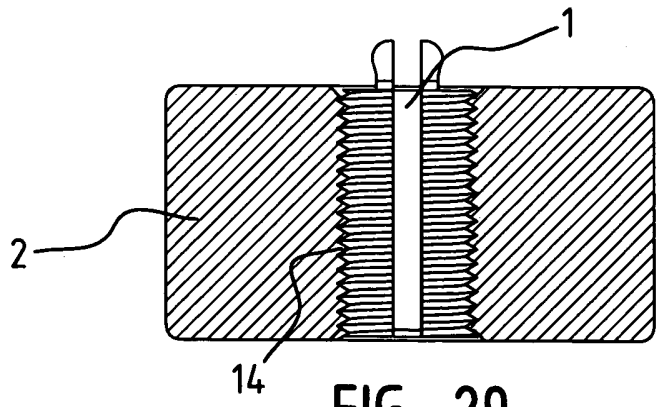

FIG. 29

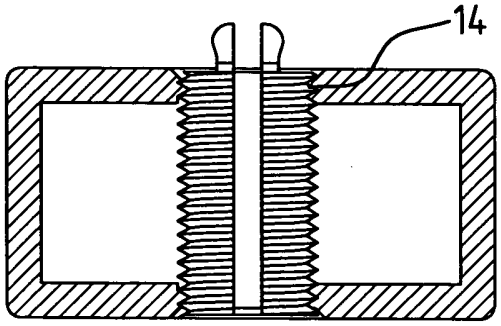

FIG. 30

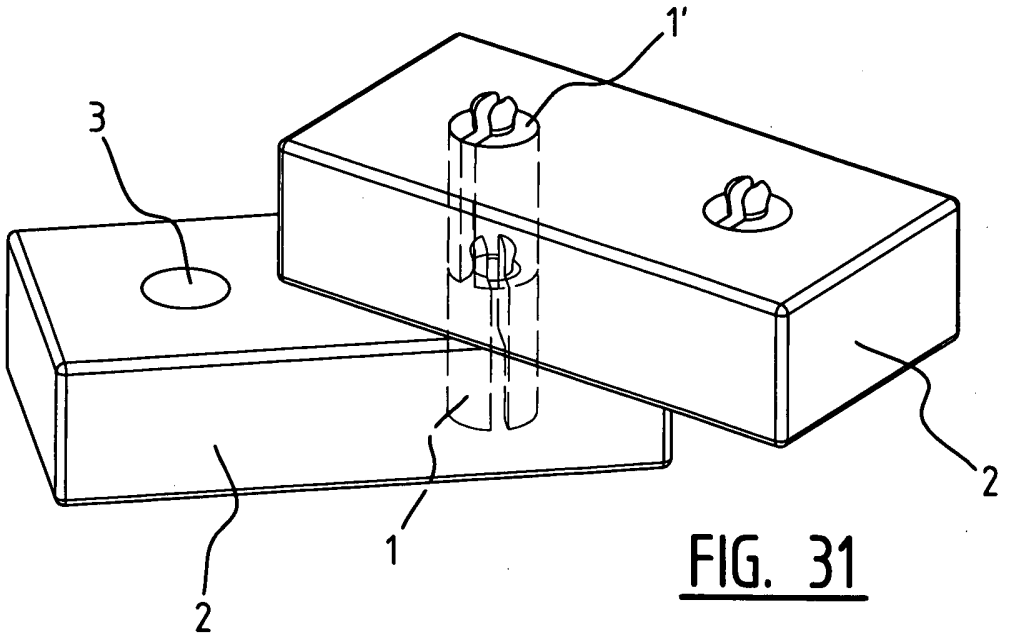

FIG. 31

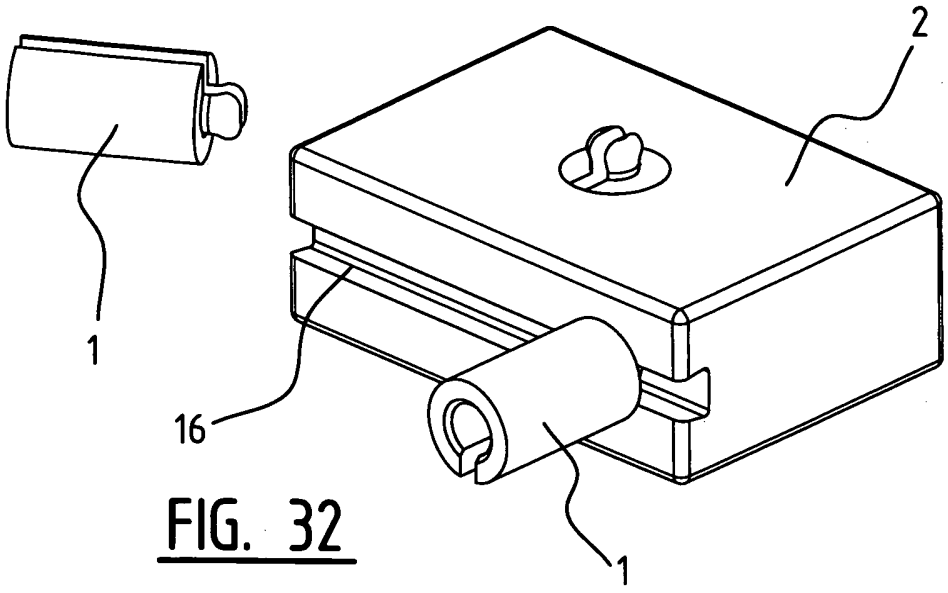

FIG. 32

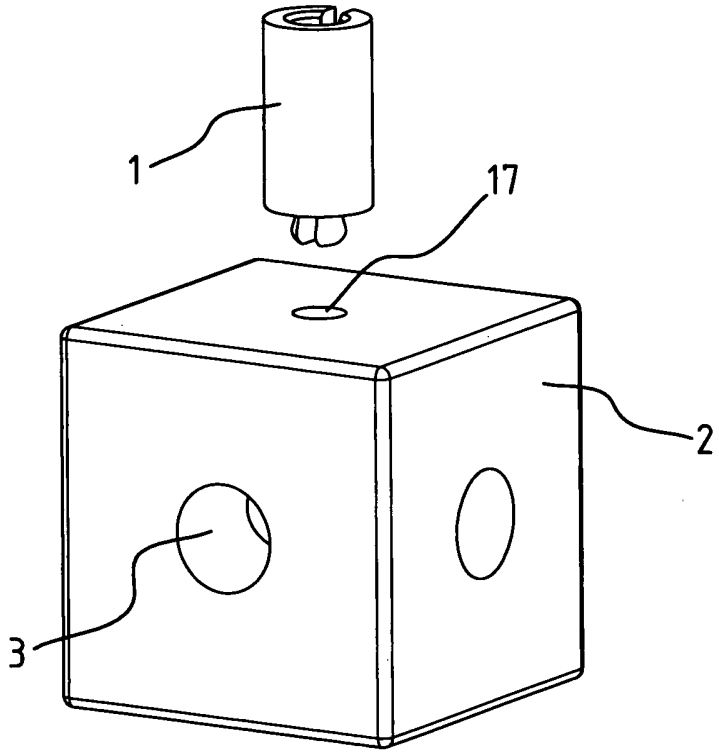

FIG. 33

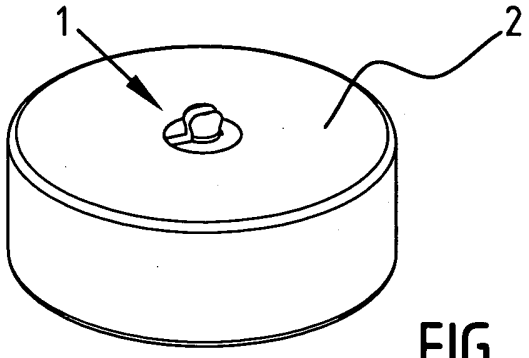

FIG. 34

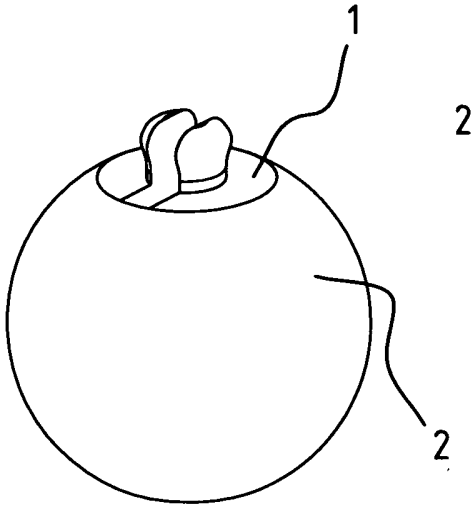

FIG. 35

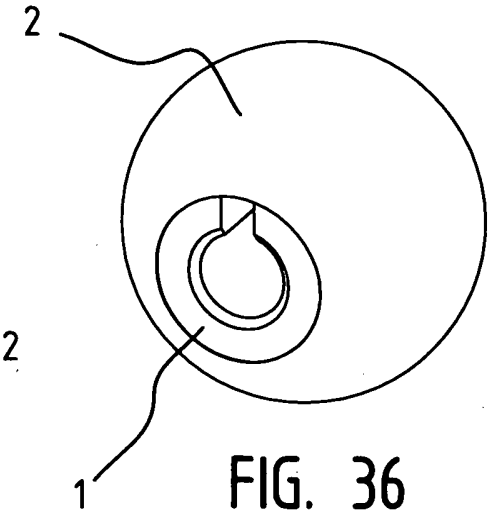

FIG. 36

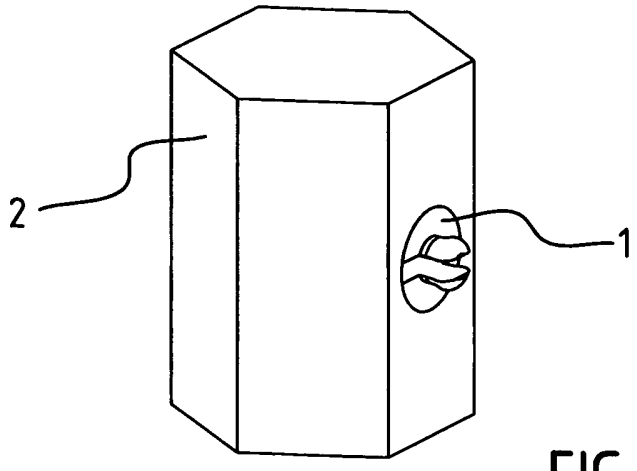

FIG. 37

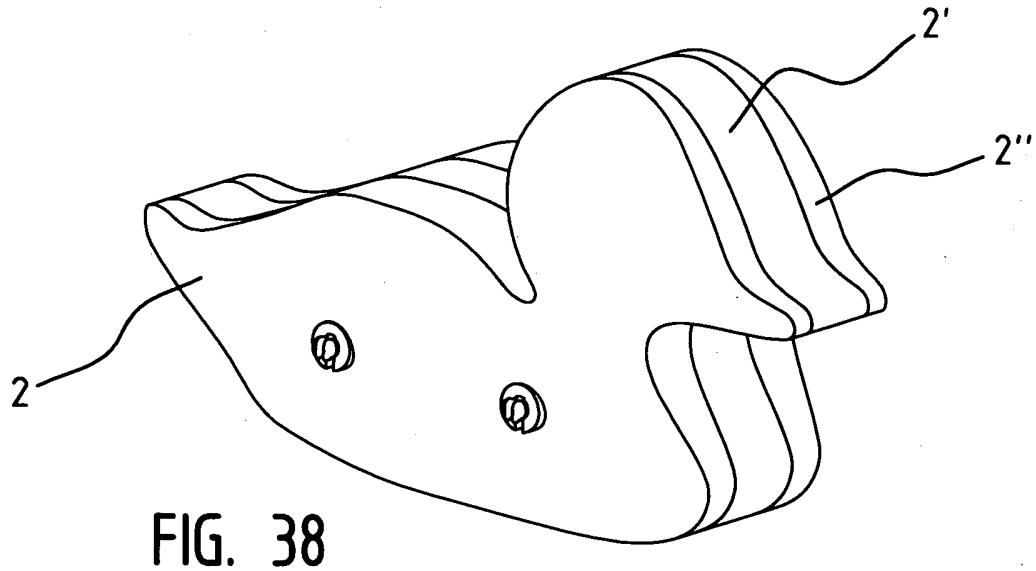

FIG. 38

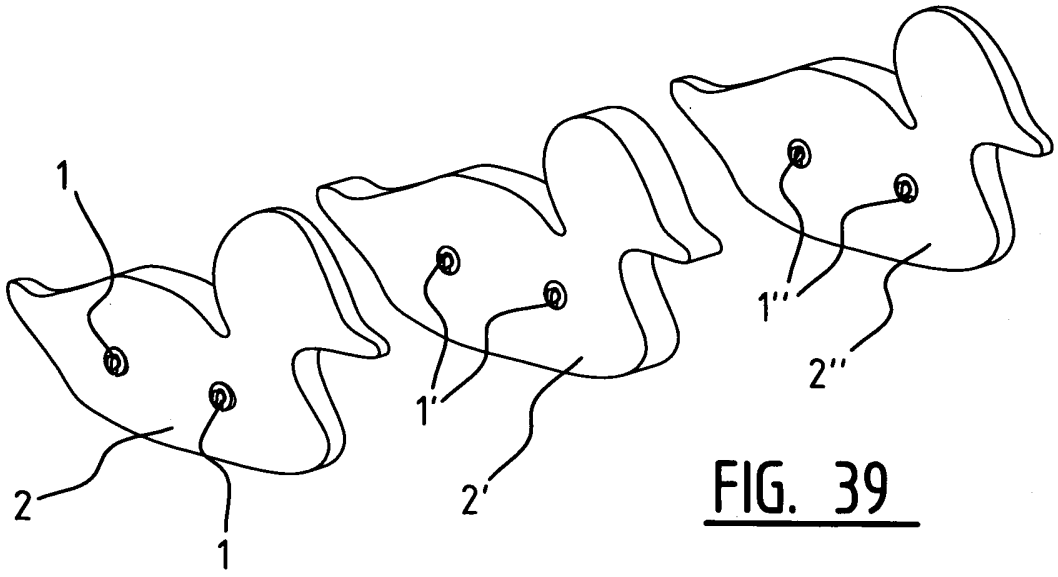

FIG. 39

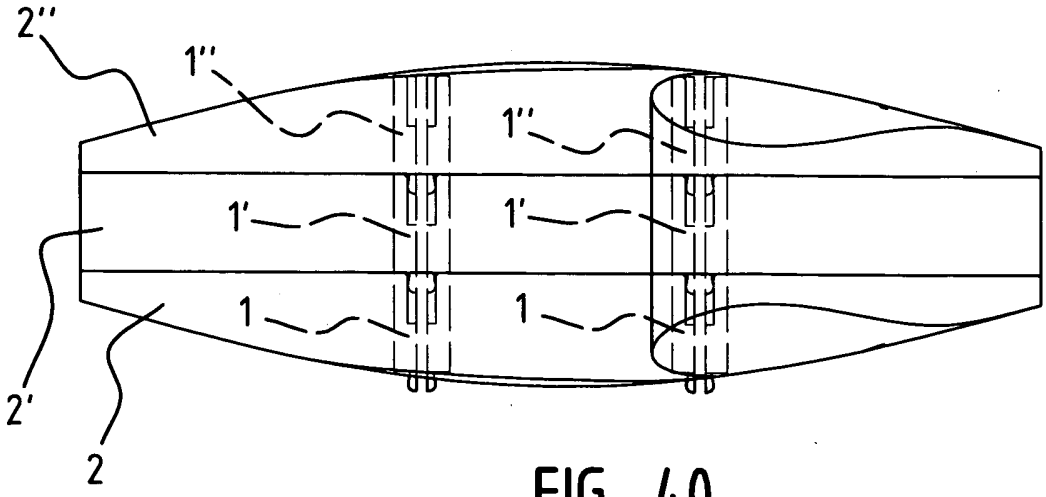

FIG. 40

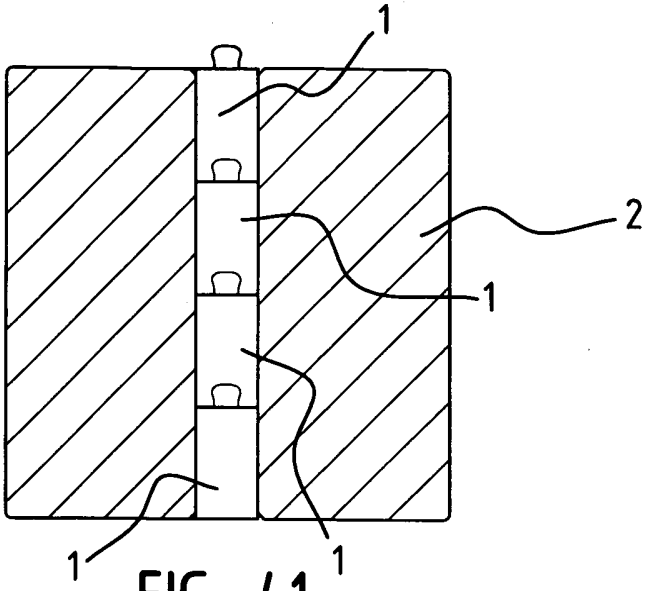

FIG. 41

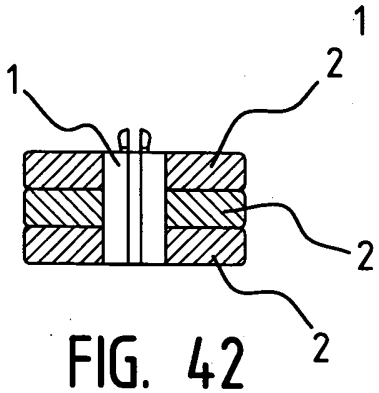

FIG. 42

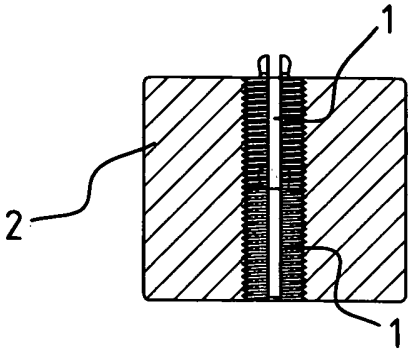

FIG. 43

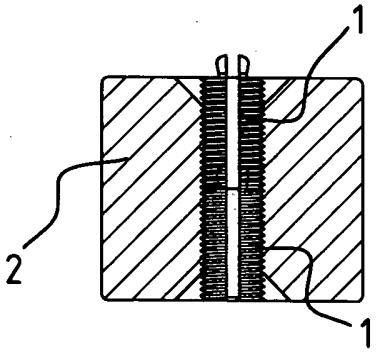

FIG. 44

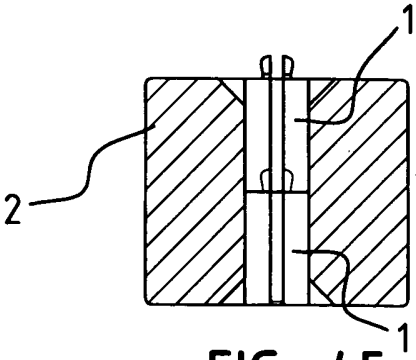

FIG. 45

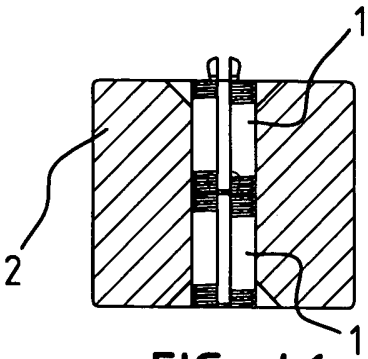

FIG. 46

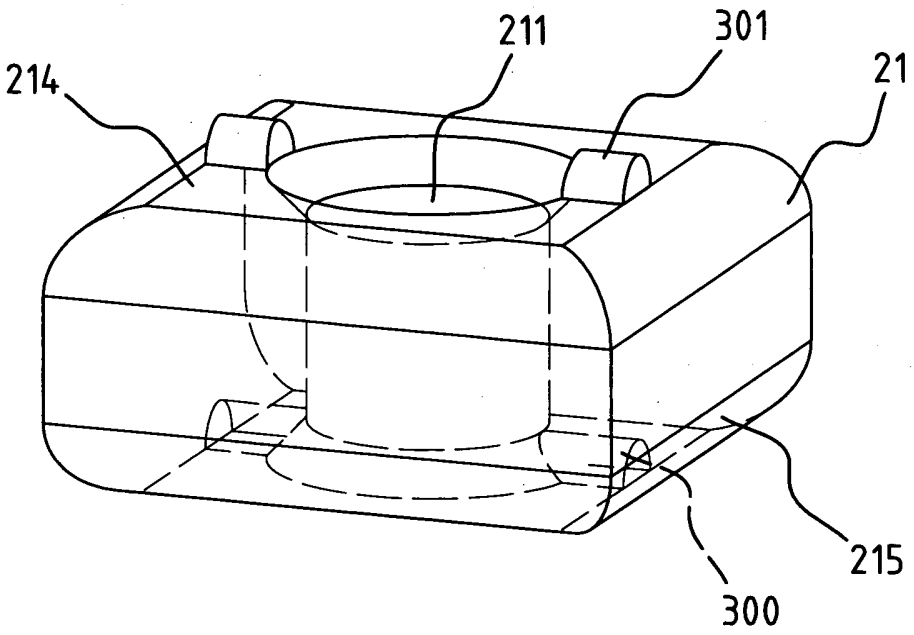

FIG. 47

INTERNATIONAL SEARCH REPORT

International application No
PCT/BE2009/000041

A. CLASSIFICATION OF SUBJECT MATTER
INV. A63H33/10
ADD. F16B19/02 F16B35/02 F16B35/06

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)
A63H F16B

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 771 650 A (WILLIAMS STEPHEN J [US] ET AL) 30 June 1998 (1998-06-30)	11
A	the whole document	1-4,6, 12,15
X	US 2008/045116 A1 (BARCELO NATHALIE [CA]) 21 February 2008 (2008-02-21)	11
A	figures 17-19	1-3,5,6, 15
X	US 6 273 778 B1 (KYSTER STEEN [DK]) 14 August 2001 (2001-08-14)	11
A	the whole document	1-3,6-8, 10,15

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 November 2009	30/11/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Schut, Timen

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/BE2009/000041

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 069 805 A (BURROWS WILLIAM M) 25 December 1962 (1962-12-25)	11
A	the whole document	1-3,8, 10,15
X	GB 2 411 605 B (WARNER TIMOTHY JOHN [GB]) 14 February 2007 (2007-02-14)	12
Y	figures 19b,20	13
X	US 2004/226246 A1 (DOTY STEVEN E [US]) 18 November 2004 (2004-11-18)	12
Y	figure 4	13
Y	GB 481 297 A (PREMO RUBBER COMPANY LTD; ARNOLD LEVY) 9 March 1938 (1938-03-09) figures 1-3	13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/BE2009/000041

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-10 and 15

   Claims 1-10 and 15 directed to a connecting element with the features as shown in fig. 13 albeit that the snap connection is not visible in fig. 13 or a kit comprising the connecting element.

   ---

2. claim: 11

   Claim 11 directed to an ordinary building block like with a hole shown in fig. 17 of D2.

   ---

3. claims: 12,13

   Claims 12, 13 directed to a building block with a widening hole and a limited annular recess.

   ---

4. claim: 14

   Claim 14 directed to an annular element adapted to connect to a screw thread of a connecting element.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/BE2009/000041

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5771650 A	30-06-1998	NONE	
US 2008045116 A1	21-02-2008	CA 2569032 A1	24-11-2005
		WO 2005110571 A1	24-11-2005
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		WO 2005084770 A2	15-09-2005
		US 2008214087 A1	04-09-2008
US 2004226246 A1	18-11-2004	WO 2004104313 A1	02-12-2004
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