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(54) **Bettered, high thermal, and/or sound insulating modular elements suitable for buildings.**

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Description

This invention relates to modular elements having high thermal and/or sound insulating properties, suitable for the erection of mainly reinforced concrete buildings. This invention also refers to building components, in particular internal and/or external walls designed to form the essential, or at least prevalent part of buildings for housing, offices, warehouses, industrial buildings, and other kinds, the said components being obtained using the said single, or multiple modular elements, the multiplicity always referring to a whole multiple of the unit.

Concrete buildings, generally reinforced concrete type are known, containing modular elements with expendable insulating forms.

This is due to the fact that, in these buildings the forms are buried in the masonry structure and hence are not recoverable.

Notoriously, these structures have different advantageous prerogatives, both in view of their thermal and/or sound insulating property and that of the erection of the materials. In the resulting structures, in particular the perimeter and/or internal walls, the expendable insulating forms are buried and variously arranged and joined with a satisfactory, but incomplete continuity in the concrete mass.

Several structures include double walls in which metallic components are present, in particular reinforcing iron bars which, as is known in the art, are buried in the concrete mass poured, or "cast" into the gap existing between the two walls.

As is known the walls of the said forms are preferably realised using components which in turn are produced with polymeric materials having high insulating properties and a very low specific weight, such as polystyrene foam.

In addition, in buildings the single walls are kept at the foreseen distance, generally modular, by separation inserts which acts as spacers for the reinforcing iron bars.

These separation inserts are also metallic and constitute other thermal and sound "bridges" which alter the desirable discontinuity in the heat and sound transmission. Consequently, the known structures do not have the required complete heat, cold, hence thermal and sound insulating properties. In addition, the preliminary operations for the erection of the double walls and the preparation of the relative moulds are fairly complex and numerous.

In fact, the said operations include introduction of the said inserts, which act as spacers and which form an equal number of "thermal or sound bridges" and require the prior decision regarding the spacing between the double walls associated with the final size of the separation inserts.

In addition, the stability of the expandable structure may be faulty and incomplete during the overlaying operation in the waiting phase before filling with concrete.

FR—A—2,173,309 discloses an expandable

thermal and/or sound insulating modular element, suitable for the formation of buildings by the overlying and longitudinal flanking of several modular elements each of the same type, made of self-extinguishing foam plastic material having an essentially cubic configuration and dove-tail reliefs or projections and cavities extending along at least a part of the surfaces adjacent to the upper face. The relieves or projections have the same disposition in two opposite lateral surfaces and displaced in the other opposite lateral surfaces thereby the projections of one surface correspond to the cavities of the opposite surface. A drawback of the disclosed modular elements is due to the fact that in each modular element and in the completed buildings, passages to position various lines, such as water pipes, variously insulated electric cables, antenna down lines, for radio and/or television receivers, telephone systems and other users are not foreseen.

As a consequence, the absence of longitudinal passages in the gaps between the double walls in the concrete mass necessarily requires a partial demolition and the formation of discontinuities for the passage of the said lines.

Furthermore, the internal and/or external plastering of known buildings is achievable with the most desirable positional stability. In fact, since "setting" of the cement mortar requires a certain waiting time, the said mortar tends to slip down the walls, despite the use of setting accelerators and the pre-arrangement of reliefs and/or grooves on the surfaces of the foam components, the said reliefs and grooves generally being continuous and orientated in a vertical direction. Other methods to achieve the required thermal and/or sound insulation are known, such as the application of insulating materials inside the gaps of numerous traditional building components, or the use of the elements made using insulating material for the realisation of floors and/or walls with reinforced concrete parts cast in loco.

However, even these latter methods have several drawbacks, such as the presence of thermal bridges, the non-uniformity of the degree of thermal insulation over the surfaces, the rigidity of the modular dimensions, the presence of joints, or of flanking lines, the difficult seal of linings and of plasters and so forth.

The object of this invention is that of providing new elements, preferably but not critically modular for the erection of reinforced concrete buildings, having high and practically homogeneous thermal and/or sound insulating properties, which do not have the above mentioned drawbacks.

More in particular, the object of this invention is to provide new elements, preferably modular, having high thermal and sound insulating properties to be used individually, or in combination for the formation of building components, such as internal and/or external walls having the fullest degree of the said thermal and sound insulating properties.

Another object of this invention is to provide new modular elements which besides having the above detailed properties may be readily inserted so as to ensure their stability when overlaid, aligned and/or placed side by side.

A further object of this invention is that of providing building components, in particular internal and/or external walls, designated to constitute the essential, or at least prevalent part of buildings for civil and/or industrial use, such as housings, offices, warehouses, industrial buildings, or other structures formed by individual or multiple elements, the multiplicity always referring to a whole multiple of the unit.

According to this invention, these and other objects are achieved by using an expandable thermal and/or sound insulating modular element suitable for the formation of buildings by the overlying and longitudinal flanking of several modular elements each of the same type, made of self-extinguishing foam plastic material, having an essentially cubic configuration and provided with main and secondary passages or holes passing completely through the element and extending perpendicular to the upper face and with dove-tail reliefs or projections and cavities having complementary configurations, said reliefs or projections having the same disposition on two opposite lateral surfaces and displaced on the other opposite lateral surfaces thereby the projections of one surface correspond to the cavities of the opposite surface, wherein the main passage or hole has a thin and deformable internal projection in proximity to its smaller end to ensure the filling of possible gaps between the overlaid elements, thereby integrating the continuity of the thermal and/or sound insulation in the building.

The said dove-tail reliefs make it possible to create a structure on the continuous surfaces that is suitable to receive and stably hold layers of plaster, as well as to form a bond between the elements that are adjacent to one another even when at a right angle, when internal and/or external walls are formed.

Any expendable plastic may be used to make this element, even if polystyrene is preferred. The bettered element of this invention has a main through passage, or hole. The holes of each element communicate with one another in the continuity of the overlaid elements and are designed, in the said continuity, to form the spaces inside which it is intended to cast, or pour the cement material which in turn is to form the load-bearing and resistant structure of the building wall. In addition, the bettered element of this invention has secondary holes, or passage substantially parallel to the said main hole to position the electric and/or water lines and other lines in the building structure.

The said main passage or hole, which for its primary function may be defined as a "casting or pouring hole" may have any geometric cross section, cylindrical, square, polygonal, provided it can be inserted in a circle and preferably is

substantially a truncated cone and emerges with a projection, or small collar. The said small collar is repeated for each main passage or hole which the element has in the event that it includes numerous modular components.

The said small collar which projects in the lower part of the element is designed to penetrate inside a coherent opening pre-arranged in the overlaid element.

The same element has a cavity at the opening of the main hole, or passage capable of receiving the projecting part belonging to the over-laying element.

Consequently, each individual element has at least one projection and at least one recess on the two upper and lower surfaces respectively, to assure material continuity and stability in the series of overlaid elements. According to the main feature of the present invention, each main passage, or hole near to its opening and adjacent to the said projection, has a further thin projection, directed towards the inside and designed to contribute to the closure of the continuity solution between the overlaying elements and the essential thermal seal between the said elements themselves.

The said thin projections, in the case of elements having at least two main casting or pouring holes or passages, are interconnected by projecting segments arranged in the plane that contains all the various holes or passages. The projections are accompanied by coherent cavities inside which the projections of the overlying element enter. These penetrated projections and cavities also contribute to the thermal and/or sound continuity and in addition to the stability of the series of overlying and stacked elements in the formation of expendable structures destined to receive the concrete cast. Consequently, each individual element has at least one or more of the said projections and/or recesses, or cavities contained in the plane of the axis for the said main holes or passages which, as previously said, preferably have a truncated cone shape, but may have other geometric sections if desired, for example, square, regular polygon, or others.

The structural and functional characteristics of the bettered, modular element, according to the invention, will be understood better in the following detailed description in which reference is made to the figures in the attached drawings which illustrate several embodiment examples of different expendable, modular types of element, data, of an exemplificative, but non-limitative nature for this invention where:

Figure 1, represents the perspective view of a bettered modular element of this invention;

Figure 2, represents the perspective view from below of the modular element of Fig. 1;

Figures 3 and 4 represent the schematic views of the cross-section of the modular element of Figures 1 and 2, obtained with a plane and in the direction indicated by III—III and IV—IV respectively in Figure 1;

Figure 5 represents the plan view of numerous

similar single elements linked to one another by dove-tail joints;

Figure 6 represents the plan view of a multiple element that may be produced in a single parallelepipedon piece and that materialises a combination of four single elements;

Figure 7 is a perspective view of a multiple element which materialises a combination of only two single elements;

Figure 8 represents the plan view of an expendable angular structure formed by the linking of three single elements arranged linearly and joined at a right angle to a further single element;

Figure 9 represents the perspective view of another combination including, in different planes, a single element linked to numerous pairs, each formed by two elements, conforming to that of Figure 7, in particular for the erection of an internal and/or external wall;

Figures 10 and 11 represent the plan view of single elements according to an embodiment variant when the main holes or passages have a square and hexagonal cross-section respectively;

Figure 12 represents the sectional view, with a through plane for the axis of the main holes, of numerous overlying single elements in a position of mutual insertion, one of which is spaced, in the insertion phase;

Figure 13 represents the sectional view of the two lower elements inserted in Figure 12, with a through plane for the axis of one of the secondary holes, and Figures 14 and 15 represent the section views of the projections inserted in the said main holes before casting the concrete and after the said casting operation respectively, the inserted modular elements being arranged in an expendable manner in a reinforced concrete structure using iron bars inserted in the main holes.

With particular reference to Figures 1 and 2 the bettered modular element 10 subject of this invention has the form of a cube obviously made up of six equal faces which for the sake of simplicity will be called upper face 12, lower face 14, a pair of opposite side faces 30 as the sides and a pair of opposite side faces 32 as the head.

The modular element 10 has a main through hole or passage 16 designed to be filled and saturated by the concrete cast. The said upper face 12 of element 10 has a cavity 18 which substantially defines the said main hole 16, a cavity which is coherent with the projection 20 included in the lower face 14 of the element 10 itself.

To contribute to the best joint between the overlying elements 10, the said cavity 18 is diametrically interrupted by lengths of cavity 22 which in turn are coherent with the projection lengths 24 on the lower face 14.

The element cube 10, also has secondary holes 26 designed if necessary, to accommodate electric and/or water lines, or other services.

Projections 28, with a dove-tail section are formed on at least part of the remaining side faces of the cube which makes-up the element 10.

The said projections do not completely occupy

all the surfaces of the face on the pair of opposite faces 30 which serve as sides, but terminate with a given inclination on them. The said projections 28 serve to retain the plastering of the masonry wall to be erected, as well as to permit both the joint between the elements mutually arranged at a right angle (as illustrated in figure 8) and linking between elements placed side by side.

The said dove-tail projections 28 in the remaining opposite faces 32 that serve as heads extend without discontinuity on the surfaces of the faces themselves, assisting the linear linkage between the adjacent elements (as illustrated in figure 5). For this purpose, the dove-tail projections 28 on each of the opposite faces 32 are displaced so that the projections of one face correspond to the hollows of the said dove-tail shape on the opposite face.

As may be observed in Figures 3 and 4 the main hole, or passage 16 which completely passes through the element 10 is preferably a truncated cone (in the case of a hole with a circular cross-section), but may also have a different cross-section, for example, square and/or polygonal, but always preferably inscribable in a circle (as represented in figures 10 and 11). At the same end of the said main passage 16 a relatively thin internal projection 34 is arranged but which is sufficient to ensure the continuity of the overlying elements. The said thin projections 34, by deforming as a result of the concrete cast 36 (see figure 15) ensures the filling of possible gaps that may form between the overlaid elements 10 and hence integrated the continuity of the thermal and/or sound insulation in the building. The concrete cast 36 is commonly reinforced with "iron bars" 38 that are inserted inside the said holes 16 in the erection of generally load-bearing masonry. As may be observed in figures 12 and 13, the penetration of the overlaid elements 10 is complete in the material continuity of the structure and in addition, both the main holes 16 and the secondary holes 26 are coaxially aligned, ensuring both the continuity of the concrete cast 36 and the positioning and arrangement of the water, electric lines and other services.

Figures 6 and 7 illustrate multiple elements which are produced each in a single homogeneous structure inscribable in a variously elongated parallelepipedon that, in the case of the multiple element 40 (Figure 6) materialises four elementary and aligned cubes, whereas in the case of the multiple element 42 (Figure 7) it materialises only two elementary, adjacent cubes. Each one of the multiple structures 40 and 42 has a number of main 16 and secondary 26 holes corresponding to each elementary cubic part of which it is formed, as well as dove-tails 28 which do not fully occupy the surfaces of the opposite faces 30, serving as a side and dove-tails 28 that extend over the entire surface of the respective opposite faces 32, serving as a head.

Figure 9 illustrates how an expendable composite structure 50 may be realised, suitable for the erection of an external or internal wall, for

example with elements 10 and 42. The said elements are made using self-extinguishing foam material and hence very light and with sound and heat insulating properties. The building structure obtained with the modular elements of this invention may be readily plastered and in a stable manner using cement mixes, by operations that are in themselves known.

Claims

1. An expandable thermal and/or sound insulating modular element (10), suitable for the formation of buildings by the overlying and longitudinal flanking of several modular elements each of the same type, made of self-extinguishing foam plastic material, having an essentially cubic configuration and provided with main (16) and secondary (26) passages or holes passing completely through the element and extending perpendicular to the upper face (12), and with dove-tail reliefs or projections (28) and cavities having complementary configurations, said reliefs or projections (28) having the same disposition on two opposite lateral surfaces (20) and displaced on the other opposite lateral surfaces (32) whereby the projections of one surface correspond to the cavities of the opposite surface, characterized in that the main passage or hole (16) has a thin and deformable internal projection (34) in proximity to its smaller end to ensure the filling of possible gaps between the overlaid elements, thereby integrating the continuity of the thermal and/or sound insulation in the building.

2. The expandable modular element according to claim 1, wherein each lateral surface (30) and (32) is provided with at least two projections (28) and with at least two cavities.

3. The expandable modular element according to claim 1 or 2, wherein the main passage (16) has a truncate conical cross-section with the smaller end disposed to the lower face of the element and with a passing port equal to the smaller surface of the passage (16).

4. The expandable modular element according to anyone of the preceding claims, wherein the upper surface (12) has a cavity (18) surrounding the main passage (16) (or the higher cross-section of the main passage (16)) and the lower surface (14) has a projection (20) surrounding the smaller cross-section of the main passage (16).

5. The expandable modular element of claim 4, wherein the cavity (18) is diametrically interrupted by cavities (22) and, correspondingly, the projection (20) is provided with projections (24) diametrically arranged and corresponding to the cavities (22) in the opposite surface.

Patentansprüche

1. Ein dehnbares Wärme- und Geräuschisolierendes modulares Element (10), geeignet für die Bildung von Gebäuden durch das Ubereinanderliegen und das in Längsrichtung seitliche Anbringen einiger modularer Elemente des gleichen

Typs, die aus selbstlöschendem PUR-Schaum hergestellt sind und grundsätzlich eine kubische Gestalt haben, versehen sind mit Haupt- (16) und Nebendurchführungen (26) oder Löchern, die vollständig durch das Element hindurchführen und sich quer zur Oberfläche (12) ausdehnen, mit schwalbenschwanzartigen Reliefs oder Vorsprüngen (28) und Höhlungen mit zusätzlichen Konfigurationen, besagte Reliefs oder Vorsprünge (28) sind in gleicher Position auf zwei seitlich einander gegenüberliegenden Oberflächen (30) angebracht und verschoben auf den anderen seitlichen gegenüberliegenden Oberflächen (32), sodass die Vorsprünge auf einer Oberfläche den Höhlungen auf der gegenüberliegenden Oberfläche entsprechen, gekennzeichnet durch die Tatsache, dass die Hauptdurchführung oder Loch (16) einen schmalen und deformierbaren internen Vorsprung (34) in der Nähe des schmaleren Endes hat, um das Füllen möglicher Lücken zwischen den übereinandergelegten Elementen zuzusichern, sodass die Kontinuität der Wärme- und Geräuschisolierung im Gebäude vervollständigt ist.

2. Das dehnbare modulare Element gemäß Anspruch 1, dessen seitliche Flächen (30) und (32) versehen sind mit zwei Vorsprüngen (28) und zwei Höhlungen.

3. Das dehnbare modulare Element gemäß Anspruch 1 und 2, bei dem sich in der Hauptdurchführung (16) ein verstümmelter konischer Querschnitt mit dem kleineren Ende zu der unteren Fläche des Elements hin befindet, mit einer Durchführung, die gleich ist der schmaleren Oberfläche der Passage (16).

4. Das dehnbare modulare Element, in Übereinstimmung mit jedem der vorigen Ansprüche, in welchen die obere Fläche (12) eine Höhlung (18) um die Hauptdurchführung (16) herum (oder um dem oberen Querschnitt der Hauptdurchführung (16)) hat, und die untere Fläche (14) einen Vorsprung (20) um den schmalere Querschnitt der Hauptdurchführung (16) hat.

5. Das dehnbare modulare Element gemäß Anspruch 4, in welchem die Öffnung (18) diametral durch Höhlungen (22) unterbrochen ist, und entsprechend der Vorsprung (20) mit Vorsprüngen (24) versehen ist, die diametral angebracht sind, entsprechend zu den Höhlen (22) in der gegenüberliegenden Fläche.

Revendications

1. Élément modulaire d'isolation phonique et/ou thermique pouvant s'expanser (10), indiqué pour la formation de bâtiments par le revêtement et la mise longitudinale de plusieurs éléments modulaires chacun du même type, faits de matière plastique de mousse autoextinguible, ayant une configuration essentiellement cubique et dotés de trous ou de passages principaux (16) et secondaires (26) qui passent complètement à travers l'élément et qui s'étendent perpendiculaires à la face supérieure (12), et avec des saillies ou des reliefs à queue d'aronde (28) et des cavités

ayant des configurations complémentaires, lesdits reliefs ou saillies (28) ayant la même disposition sur deux surfaces latérales opposées (30) et déplacés sur les autres surfaces latérales opposées où les saillies d'une surface correspondant aux cavités de la surface opposée, caractérisés par le fait que le trou ou le passage principal (16) a une saillie intérieure déformable (34) près de sa partie finale pour assurer le remplissage d'ouvertures possibles entre les éléments revêtus, intégrant par conséquent la continuité de l'isolation phonique et/ou thermique du bâtiment.

2. L'élément modulaire pouvant s'expanser d'après la revendication 1, dans lequel chaque surface latérale (30) et (32) est dotée par au moins deux saillies (28) et par au moins deux cavités.

3. L'élément modulaire pouvant s'expanser d'après la revendication 1 ou 2, dans lequel le passage principal (16) a une section transversale

en tronc de cône avec une partie finale plus petite disposées vers la face inférieure de l'élément et avec une ouverture de passage égale à la surface plus petite du passage (16).

4. L'élément modulaire pouvant s'expanser d'après n'importe quelle revendication précédente, dans lequel la surface supérieure (12) a une cavité (18) qui entoure le passage principal (16) et la surface inférieure (14) a une saillie (20) qui entoure la section transversale plus petite du passage principal (16).

5. L'élément modulaire pouvant s'expanser de la revendication 4, dans lequel la cavité (18) est interrompue diamétralement par les cavités (22) et, de manière correspondante, la saillie (20) est dotée de saillies (24) placées diamétralement et correspondant aux cavités (22) à la surface opposée.

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Fig. 1

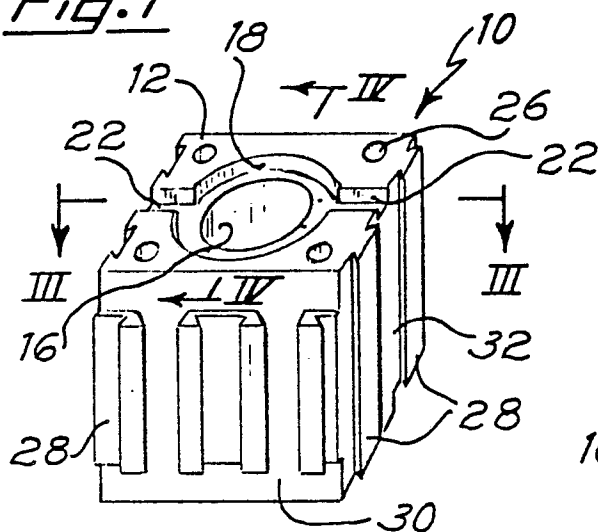


Fig. 2

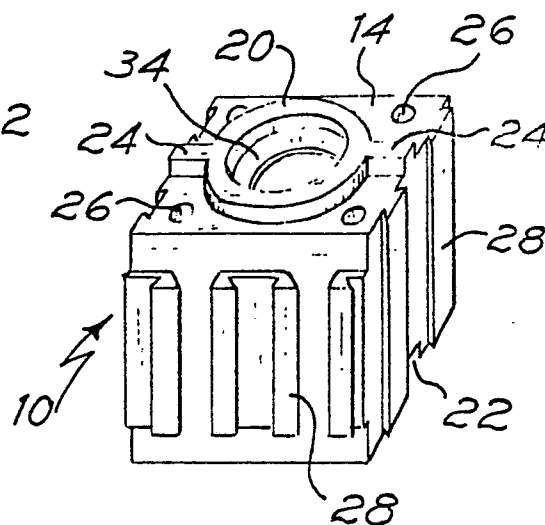


Fig. 3

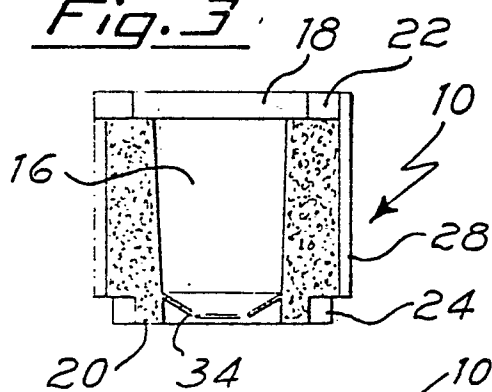


Fig. 4

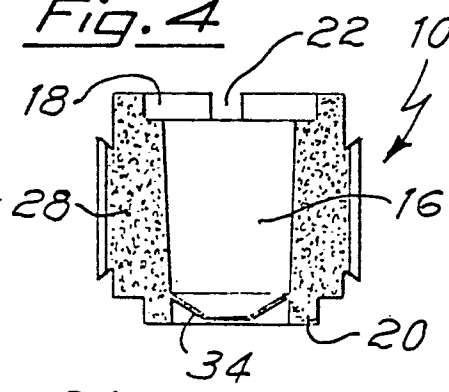


Fig. 5

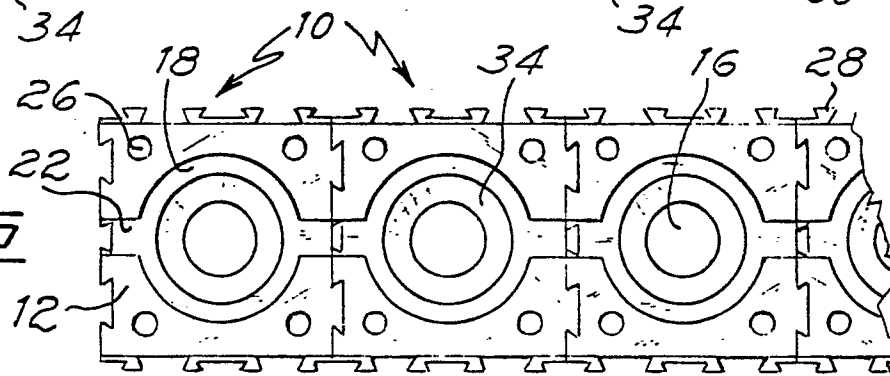
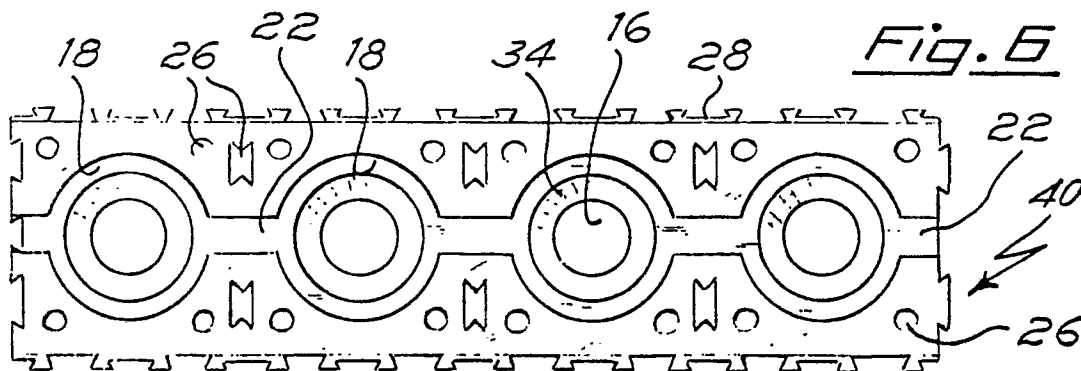


Fig. 6



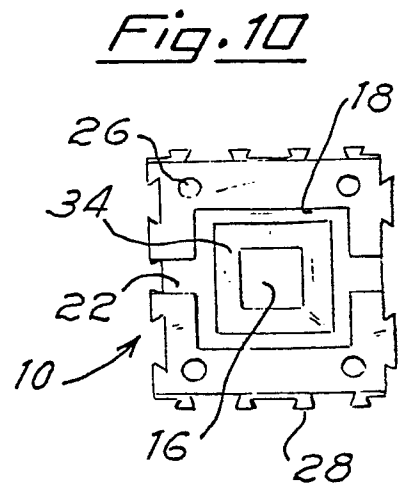
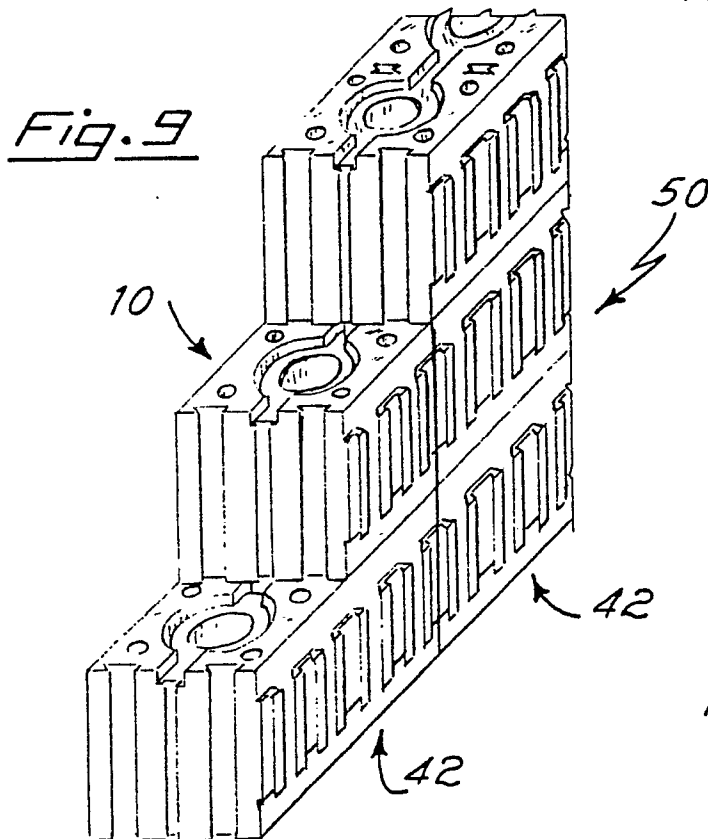
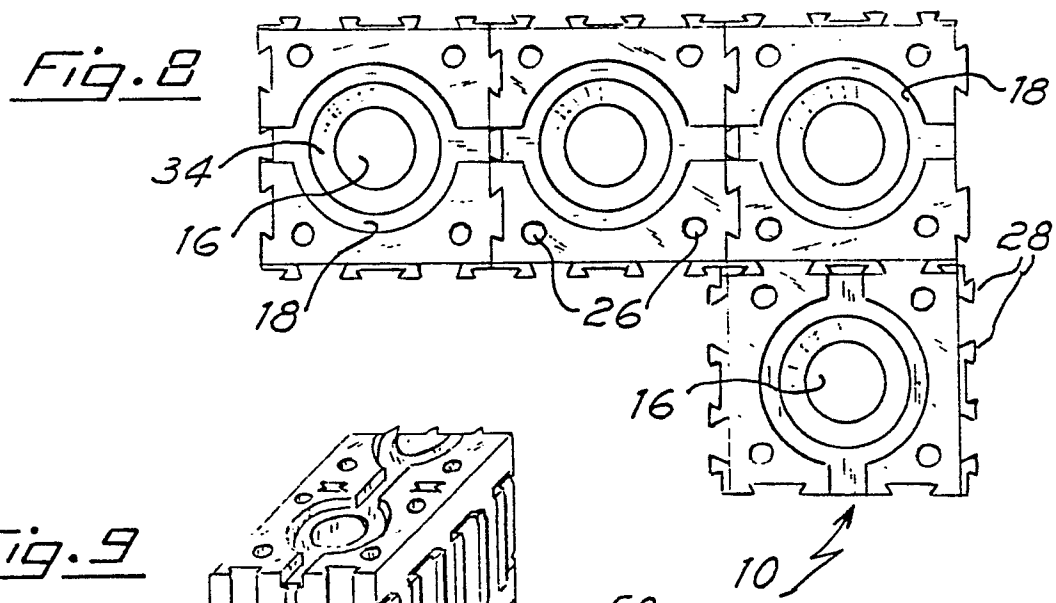
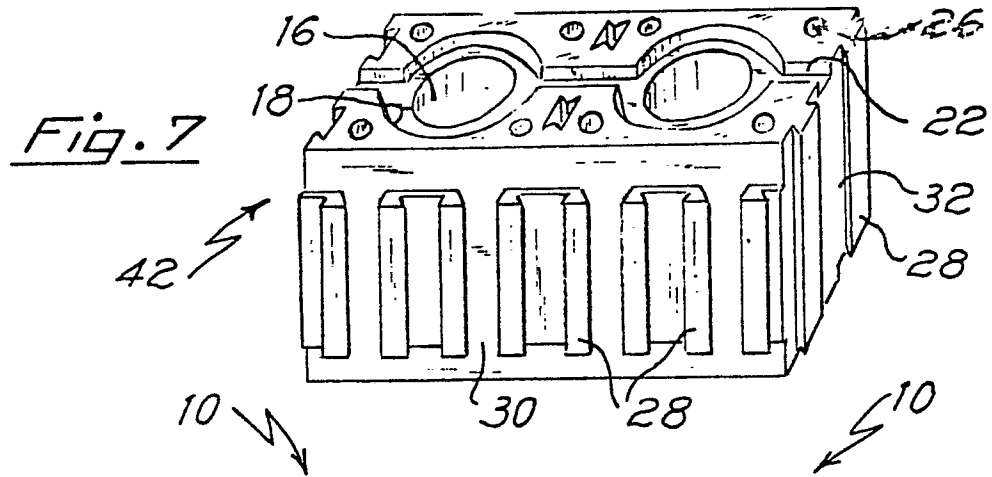


Fig.12

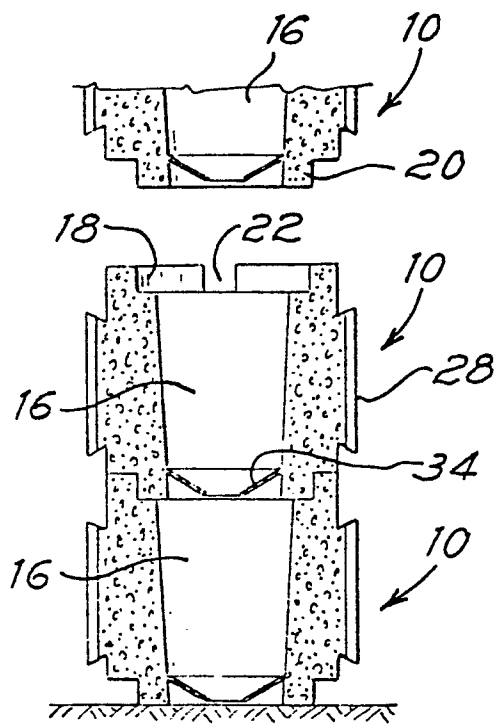


Fig.11

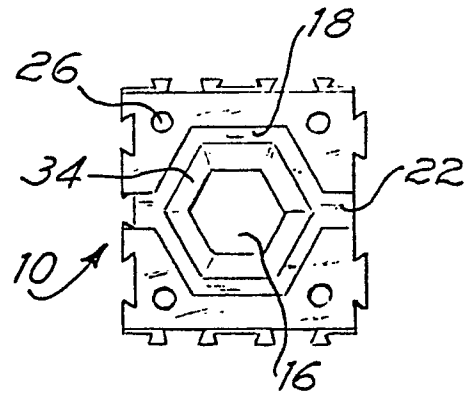


Fig.13

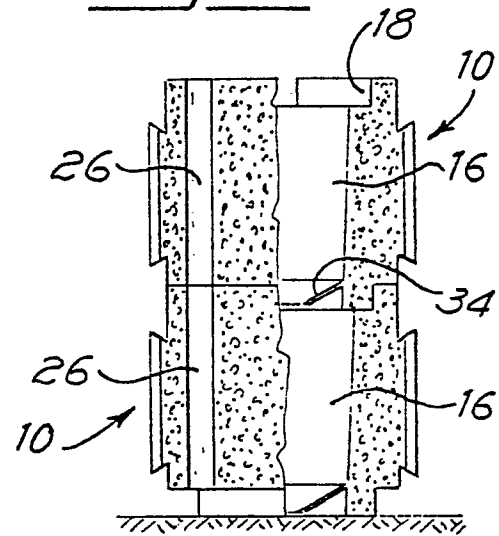


Fig.14

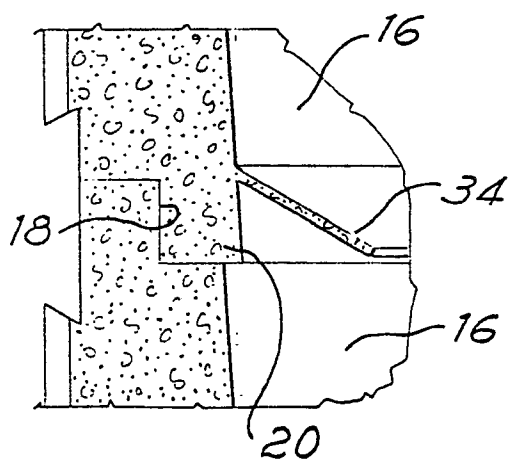


Fig.15

