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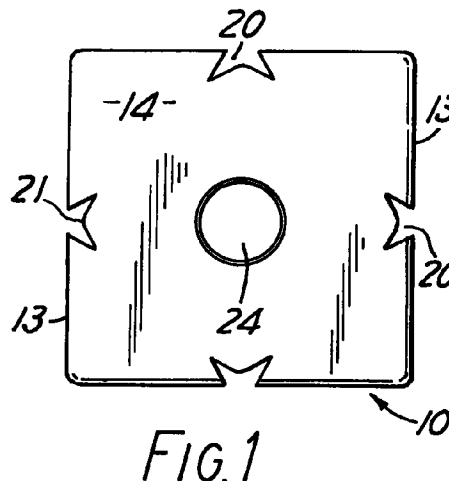
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(54) Constructional toys

(57) A constructional toy comprises main building blocks (12, 42, 60) which are typically square, triangular or rectangular in cross-section and moulded in a suitable plastics material. Each block has respectively dovetail-shaped grooves (20, 50, 64) in its side faces. The toy also includes principal connecting elements (30) each having a star-shaped cross-section, the grooves being complementary in shape to the shape of the half of any connecting element on one side of a plane which longitudinally bisects the connecting element and the opposed included angles between opposed pairs of adjacent points of its star shape. So two main elements can be secured together in at least four different orientations, successively spaced apart by 90°, by sliding one pair of adjacent points of a connecting element into a groove in one main element and sliding the same or another pair of adjacent points into a groove in the other main element.



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Description

This invention relates to constructional toys.

One prior art form of constructional toy is described in United Kingdom Patent Specification No 959 581, and comprises main building elements consisting of rectangular panels having outer edges which engage in parallel grooves in the side faces of common connector elements, to build up generally box-like structures. While such a toy can build up a variety of box-like structures, its versatility, or ability to build up other shapes, is somewhat limited.

United Kingdom Patent Application No 2 224 953 describes a constructional toy that goes a considerable way towards alleviating the lack of versatility of the prior art constructional toy. However, it is an object of the present invention to provide a constructional toy which is even more versatile than the constructional toy of United Kingdom Patent Application No 2 224 953.

According to the present invention, there is provided a constructional toy comprising a plurality of elements of at least two different types which can be assembled together to form a variety of three-dimensional structures, said elements including:

a main element in the form of a building block having a plurality of flat side surfaces, at least one of said surfaces having a groove therein, said groove having a mouth narrower than the remainder thereof; and
an elongate connecting element having a cross-section in the shape of a symmetrical four pointed star, said connecting element being a tight sliding fit in said groove, with any two adjacent points of its star-shaped cross-section trapped in the groove and the other two points disposed outside the groove;

whereby two of said main elements can be secured together in four relative orientations, successively spaced apart by 90°, by means of one of said connecting elements engaged in a respective groove in each main element;

wherein at least some main elements are triangular in cross-section, and at least some main elements are square in cross-section.

The points of the star-shape of the cross-section of the connecting element may be rounded or squared, in which case the side surfaces of each point are advantageously made substantially parallel to each other, whereby to render the star-shape substantially cruciform.

Preferably, each groove is shaped to be substantially complementary in cross-section to the cross-sectional shape of any two adjacent points of the star-shaped cross-section of the connecting element.

In a preferred embodiment of the invention, the grooves have slight indentations at each end thereof, which cooperate with complementary slight projections

provided at each end of the connecting elements on each star point of their cross-sectional shape. The connecting elements may have further slight projections, similar to the firstmentioned projections but of twice the length, at their midpoints, again on each star point of their cross-sectional shape, for co-operating with said slight indentations.

Conveniently, each main element has first and second substantially planar, parallel, ends which are interconnected by said side surfaces. Further, each of said side surfaces preferably extends perpendicularly to said ends.

The toy may include additional main elements, each having a cross-section, perpendicular to said side surfaces, in the shape of a rectangle or a regular hexagon.

The main elements and connecting elements may be made in a plurality of heights, of which the greater heights are conveniently integral multiples of the smallest height.

Said side surfaces of the triangular, square and hexagonal main elements are preferably all of the same width, while for the rectangular main elements, the shorter side surfaces are preferably of the same width as the side surfaces of the triangular, square and hexagonal main elements and the longer side surfaces are preferably of twice this width.

In a preferred embodiment of the invention, the main elements are all hollow, with one of said planar ends closed and the other open.

Preferably, all the elements are moulded in a suitable plastics material, for example ABS, acrylic plastic, polystyrene or polypropylene.

The invention will now be described, by way of example only, with reference to the accompanying drawings, of which:

Figures 1 to 4 are respectively top, bottom, side and sectional views of one form of main building element of a constructional toy in accordance with the present invention;

Figure 5 is a perspective view of the element of Figures 1 to 4 from its underside;

Figures 6 and 7 are much enlarged cross-sectional and side views respectively of a connecting element for use with the main building elements of Figures 1 to 5;

Figure 8 to 10 are respectively top, bottom and sectional views of another form of main building element of the constructional toy of the present invention;

Figures 11 to 13 are respectively top, bottom and sectional views of yet another form of main building element of the constructional toy of the present invention;

Figures 14 to 17 show a variety of ways in which the elements of Figures 1 to 13 can be connected together;

Figure 18 is a cross-sectional view of an alternative

form of the connecting element of Figures 6 and 7; Figures 19 to 21 are plan, side and perspective views respectively of an auxiliary connecting element of the constructional toy of the present invention;

Figures 22 to 24 are plan, side and perspective views respectively of another form of auxiliary connecting element of the constructional toy of the present invention;

Figures 25 to 27 are plan, side and perspective views respectively of a still further form of auxiliary connecting element of the constructional toy of the present invention; and

Figures 28 to 30 are plan, side and perspective views respectively of yet another form of auxiliary connecting element of the constructional toy of the present invention.

The main building element of Figures 1 to 5 is indicated generally at 10, and comprises a hollow square-section building block 12 having four identical rectangular side surfaces 13 each perpendicular to its two adjacent side surfaces and extending between substantially square and planar top and bottom ends 14, 16. The top end 14 is flat and substantially closed, while the bottom end 16 is open.

Each of the side surfaces 13 is provided with an identical generally dovetail-shaped groove 20 extending perpendicularly between the top and bottom ends 14, 16 along the middle of the side surface. The base of each groove 20 rises symmetrically from each side of the groove to a central ridge 21, which extends substantially the whole length of the groove and is provided at each end, for reasons which will become apparent hereinafter, with a slight cutaway portion or recess 22.

The block 12 is also provided with a cylindrical aperture or passage 24 whose axis extends from the centre of the top end 14 of the block to the centre of the bottom end 16: thus it will be appreciated that the axis of the aperture 24 extends parallel to the longitudinal axes of the grooves 20. This aperture 24 is defined by tubular walls 26 depending from and integral with the top end 14. The aperture 24 has a very slightly enlarged diameter portion 28 at its entrance in the top end 14 of the block 12, while the tubular walls 26 terminate just above the open end 16, again for reasons which will become apparent hereinafter.

The block 12 is moulded in one piece in a suitable plastics material such as ABS or polypropylene, and is typically 25 mm square by 25 mm high.

The constructional toy of the present invention comprises plurality of the blocks 12, preferably moulded in different colours. Furthermore, and as will also become apparent hereinafter, differently shaped blocks, all having grooves and apertures similar to the grooves 20 and aperture 24, are also provided. A plurality of these differently coloured blocks 12 can then be joined together, both with each other and with the differently shaped blocks, to form a great variety of interesting and/or visu-

ally attractive three-dimensional structures, by means of elongate connecting elements of the kind indicated at 30 in Figures 6 and 7.

The connecting element 30 of Figures 6 and 7 is made of the same material and in the same range of colours as the blocks 12, and has a cross-section in the form of a regular four pointed star, ie a star with four points equiangularly spaced apart by 90°. The element 30 is again 25 mm long, and the dimensions of its cross-sectional shape are such that if the cross section is diagonally divided, as shown in Figure 6 by dotted line 31, into two identical halves 32, 34 each containing two adjacent points of the star shape, then each half is closely complementary in shape to the cross-sectional shape of the grooves 20. As a result, each of the halves 32, 34 of the element 30 is a tight sliding fit within the grooves 20. Thus two of the blocks 12 can be secured together by placing respective ones of their side surfaces 13 in contact with each other, with the grooves 20 aligned with each other, and then sliding a connecting element 30 into both grooves 20 by sliding a respective one of its two-pointed halves 34, 36 into each groove. The two blocks 12 are then firmly secured together with respective ones of their side surfaces 13 held flush with each other.

The dimensions of the cross-sectional shape of the connecting element 30 and the diameter of the aperture 24 are selected such that the connecting element is also a tight sliding fit in the aperture 24. This greatly increases versatility, since it means that the blocks 12 can be connected together to partially overlap each other and in a variety of orientations, merely by engaging half the length of a connecting element 30 in the aperture 24 in one block, and the other half in a groove 20 or the aperture 24 in another block.

The connecting element 30 is further provided, at each end, with respective small projections or pips 36 typically 1.5 mm long, on each star point of its cross-sectional shape. Additionally, similar small projections or pips 38, typically 3.0 mm long, are provided on each star point of the cross-sectional shape of the connecting element 30 at the middle of its length. The pips 36 and 38 co-operate with the recesses 22 in the grooves 20, and with the enlarged diameter portions 28 of the apertures 24 and the shortened lower ends of the tubular walls 26, to provide a light locking action, or "clicking into position", when the whole length or half the length of a connecting element is inserted into a groove or an aperture.

The range of three-dimensional structures that can be built can be increased still further by incorporating additional main building elements 40 each in the form of a three-sided block of the kind indicated at 42 in Figures 8 to 10. The blocks 42 are again 25 mm high, and are made in the same material, and the same range of colours, as the blocks 12 of Figures 1 to 5. However, instead of being square, the blocks 42 have a cross-section in the shape of an equilateral triangle of 25mm each side. Thus each block 42 has flat parallel top and

bottom ends 44,46 interconnected by three identical side surfaces 48 perpendicular to the ends 44, 46 and each containing a central groove 50 identical to the grooves 20 of the blocks 12, the top end 44 being closed and the bottom end 46 being open. The blocks 42 also have central apertures 52 defined by tubular walls 54, both substantially identical to the aperture 24 and walls 26 of the block 12, and both having their axes parallel to the longitudinal axes of the grooves 50. The blocks 42 can therefore be connected to each other and to the blocks 12 by means of the connecting elements 30, again in a great variety of orientations.

A third kind of main building element is shown at 60 in Figures 11 to 13. The element 60 comprises a rectangular block 62 which is effectively two blocks 12 having their respective side faces 13 integrally joined together, to form a single rectangular block 25mm by 50mm in cross-section by 25 mm high. As a result, the block 62 has two parallel grooves 64 in each of its longer sides, and either two apertures 66, one in the centre of each half, or preferably only one such aperture, in its centre, as shown in Figures 11 to 13.

Figures 14 to 17 illustrate by way of example just a few of the relative orientations in which the elements 60 can be connected together by the elements 30, as well as some of the resulting three dimensional structures that can be built using the elements 10 and the connecting elements 30. Clearly a great variety of such structures, especially solid geometrical structures of the polyhedron kind, can be built, depending almost entirely on the imagination of the builder. One of the features of the present invention which particularly facilitates the building of large complex structures is the very strong interconnection between the main building elements 10, 40 and 60 achieved by the engagement and light locking of the star shaped cross section of the connecting elements 30 in the complementarily-shaped grooves in the main building elements.

Yet another kind of main building element (not shown), in the form of a hexagonal section block with planar ends (one closed, one open), a central aperture and grooves in each of its six side faces, can be provided if desired, again with 25mm side width, and again in the same range of colours as the blocks 12, 42 and 60, thus further extending the range of three-dimensional structures which can be built.

Several modifications can be made to the described embodiment of the invention.

For example, the dovetail-shaped grooves 20, 50 and 64 need not have the precise cross-section as shown in Figures 1 and 3, they merely need to be narrower at the mouth than at their base: the term "dovetail-shaped" as used herein is therefore used to embrace such shapes.

Furthermore, the star-shaped cross-section of the connecting elements 30 can be modified by rounding or squaring the points of its star shape, and additionally by making the side surfaces of each point substantially parallel to each other. In this latter case, the star-shaped

cross-section of the connecting elements 30 is rendered substantially cruciform, as shown in Figure 18. Also in this latter case, the dovetail-shaped grooves 20, 50 and 64 are preferably shaped to be substantially fully complementary to one diagonal half of the cruciform version of the star-shaped cross-section of the connecting elements 30, so increasing the area of contact between the connecting element and the groove 20, 50 or 64 of the respective block 12, 42 or 60. This increased contact area has the advantage that the connecting elements 30 connect the blocks 12, 42 or 60 together more firmly or securely by virtue of the increased frictional engagement.

In another modification, some of the apertures 24, 52 and 66 can be blind, rather than extending all the way through their respective blocks 12, 42 and 60: this modification is preferably implemented by closing the respective upper ends of the apertures 24, 52 and 66, as viewed in Figures 4, 10 and 13 respectively.

Also, dimensions other than those specifically mentioned can be used, and at least some of the various blocks 12, 42 and 60 can be provided in their respective end surfaces with grooves identical to those in their respective side surfaces, to increase the number of orientations in which the blocks can be connected together. Further, specialised building elements can be provided if desired, in particular elements incorporating wheels, thus enabling various trucks and trailers to be built.

Although the use of the word "height" implies that the various building elements are used in the orientation in which they are shown in the drawings, they can in fact be used in other orientations if desired, especially one in which the dimension referred to as "height" extends horizontally.

In addition to the principal connecting elements 30 of Figures 6 and 7 and Figure 18, the constructional toy of the present invention can also include a number of different auxiliary connecting elements, each based upon the half of a principal connecting element on one side of a plane which longitudinally bisects the principal element and the respective opposed included angles between opposed pairs of adjacent points of its cross-section, such that said half connecting element has a flat side defined by said plane and two star points inclined at 45° in opposite directions to the normal to said flat side.

A first such auxiliary connecting element is indicated at 70 in Figures 19 to 21, and comprises two such half members, indicated at 72, integrally joined together at the midpoints of their flat sides 74 and extending at 90° to each other. A connecting element 70 can connect together two main elements 10 with their side surfaces 13 in contact with each other but with their respective grooves 20 extending perpendicularly to each other, thus further increasing the versatility of the toy.

A second form of auxiliary connecting element is indicated at 76 in Figures 22 to 24, and comprises one half element 72 having a connecting element 30 inte-

grally joined to and projecting perpendicularly from the midpoint of its flat side 74, to form a T-shape. Again, main elements 10 can be connected together in additional relative orientations by means of the connecting elements 76.

A third form of auxiliary connecting element is indicated 78 in Figures 25 to 27, and comprises a half element 72 having one end of its flat side 74 integrally joined to and projecting perpendicularly from one end of a connecting element 30, forming an L-shape (or an inverted L-shape, as viewed in Figures 26 and 27).

Figures 28 to 30 show a fourth auxiliary connecting element 80, which is basically similar in concept to the T-shaped element 76 but has the element 30 replaced by a tubular element 82 dimensioned to be a tight sliding fit in the apertures 24, 52, 66 of the various main building elements. The free end of the element 82 is slotted at 84 to give it some resilience, and can be arranged to be rotatable in its aperture if desired, thus further increasing the possible relative orientations of the main building elements and the versatility of the toy.

Claims

1. A constructional toy comprising a plurality of elements of at least two different types which can be assembled together to form a variety of three-dimensional structures, said elements including:

a main element in the form of a building block having a plurality of flat side surfaces, at least one of said surfaces having a groove therein, said groove having a mouth narrower than the remainder thereof; and

an elongate connecting element having a cross-section in the shape of a symmetrical four pointed star, said connecting element being a tight sliding fit in said groove, with any two adjacent points of its star-shaped cross-section trapped in the groove and the other two points disposed outside the groove;

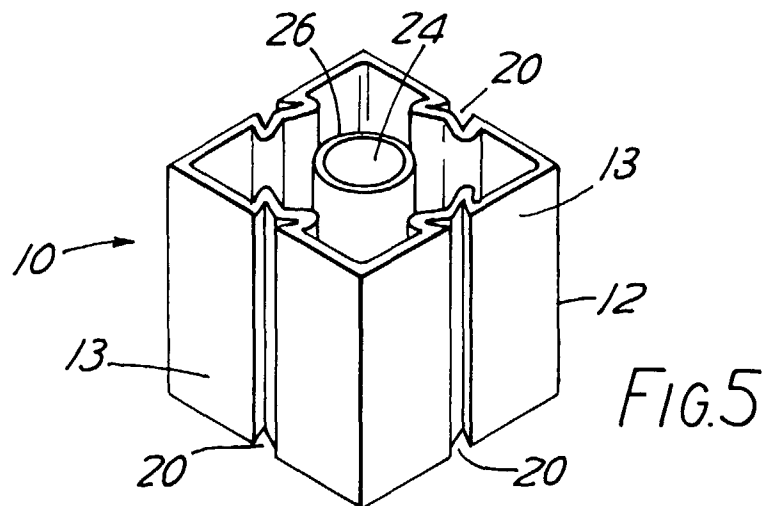
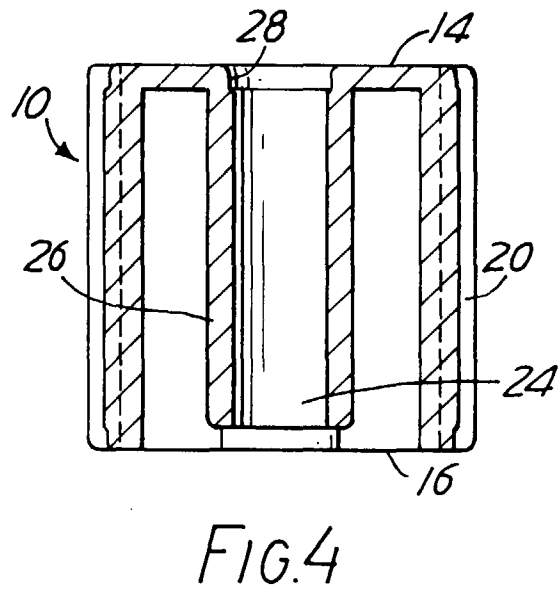
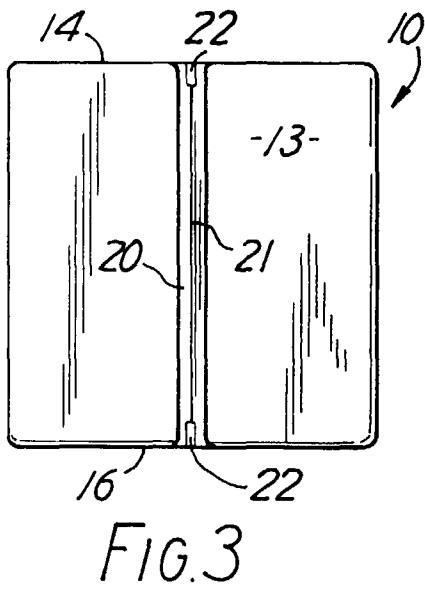
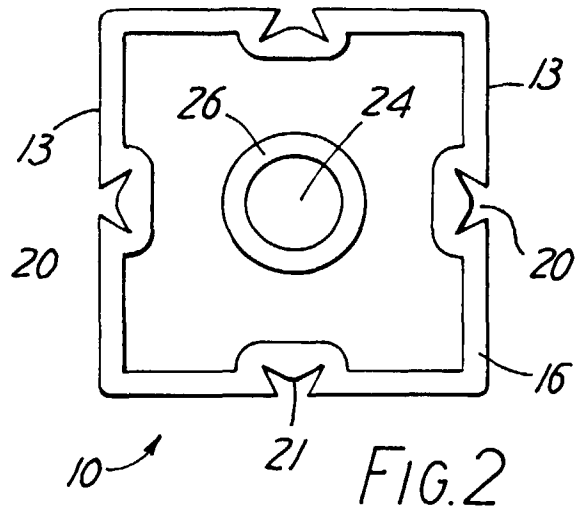
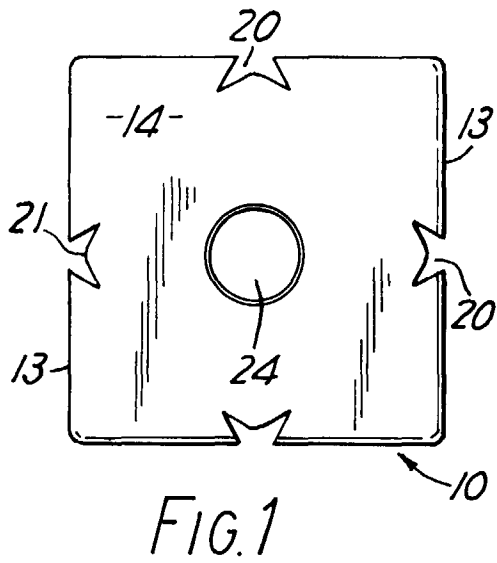
whereby two of said main elements can be secured together in four relative orientations, successively spaced apart by 90°, by means of one of said connecting elements engaged in a respective groove in each main element;

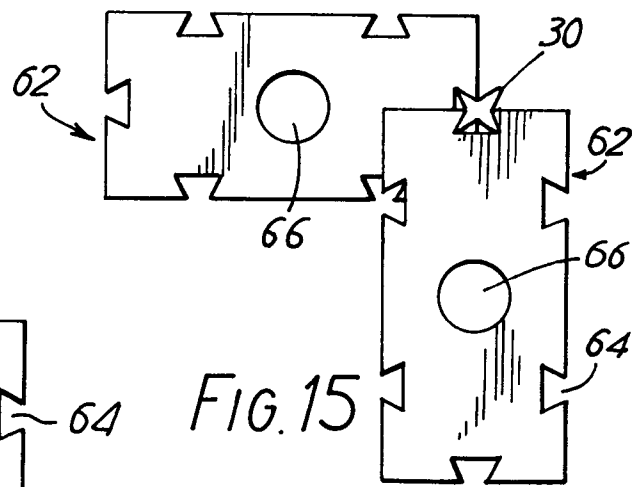
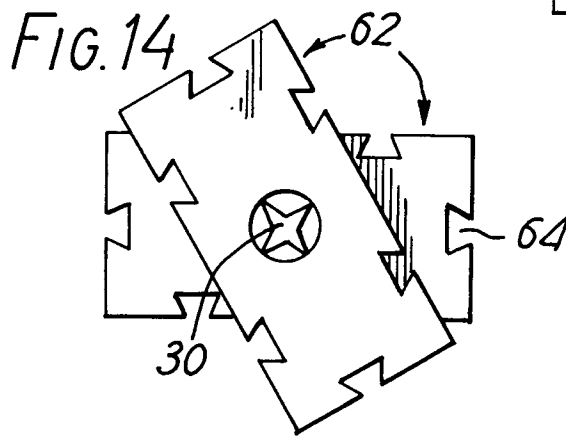
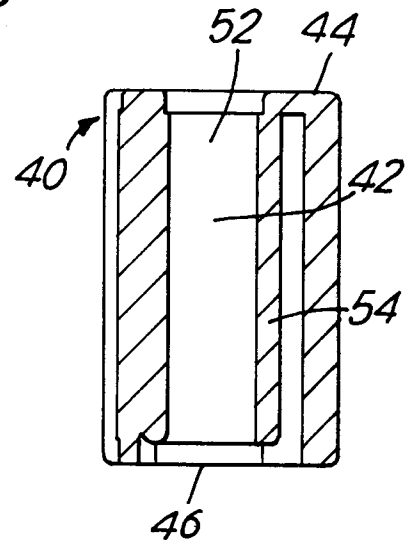
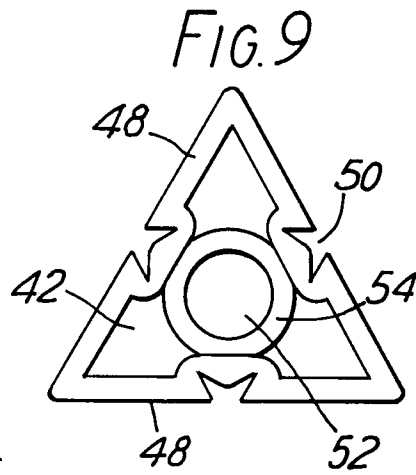
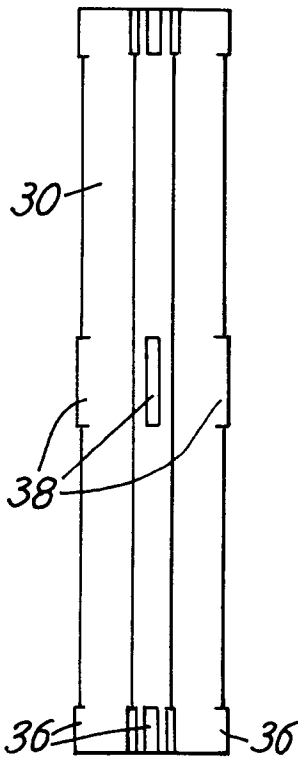
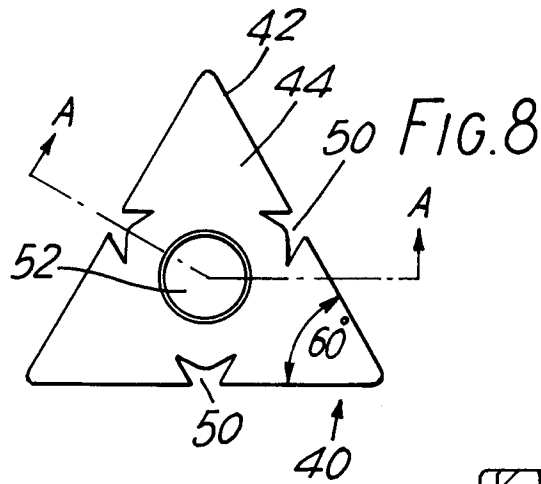
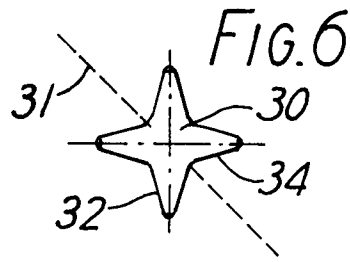
wherein at least some main elements are triangular in cross-section, and at least some main elements are square in cross-section.

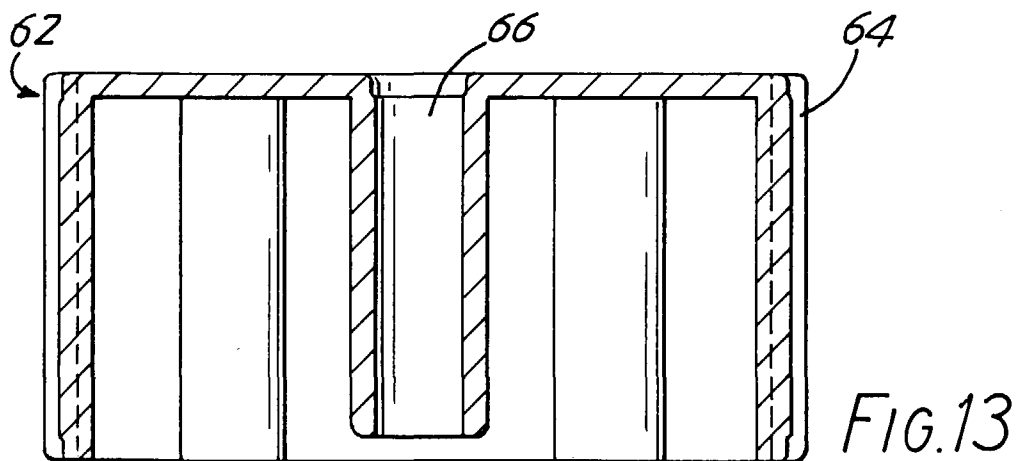
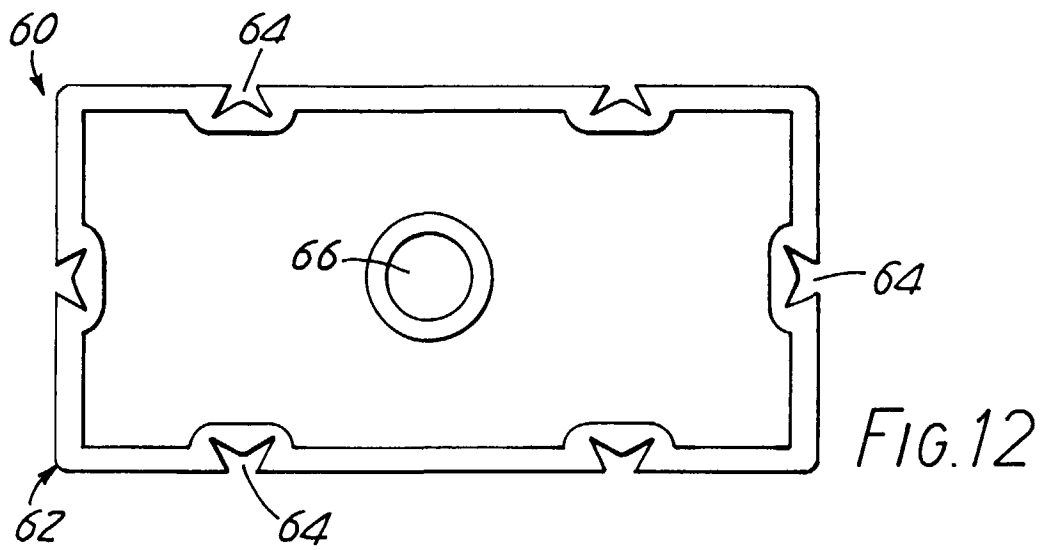
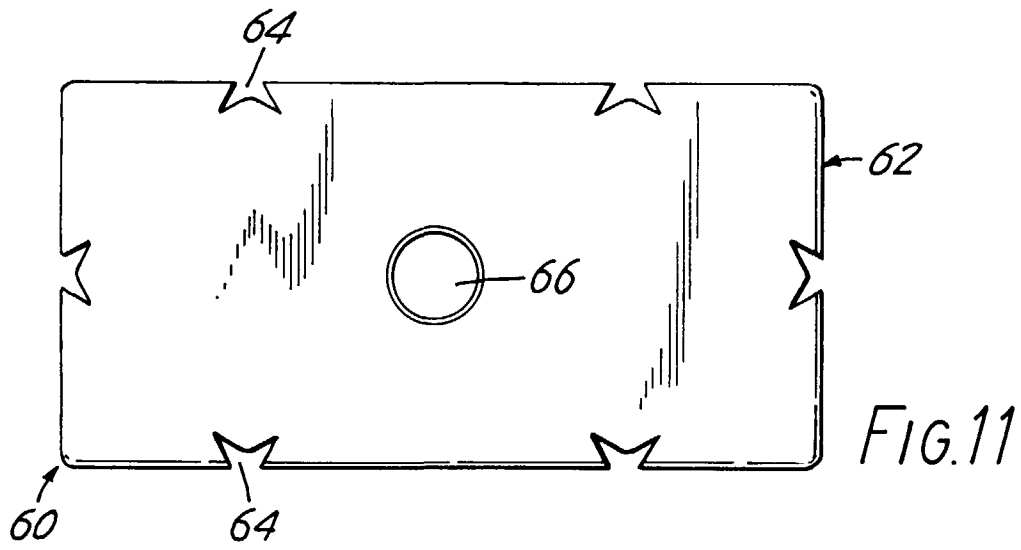
2. A constructional toy as claimed in claim 1, wherein said side surfaces of the triangular and square main elements are all of the same width.
3. A constructional toy as claimed in claim 1 or claim 2, wherein each main element has first and second substantially planar, parallel, ends which are inter-

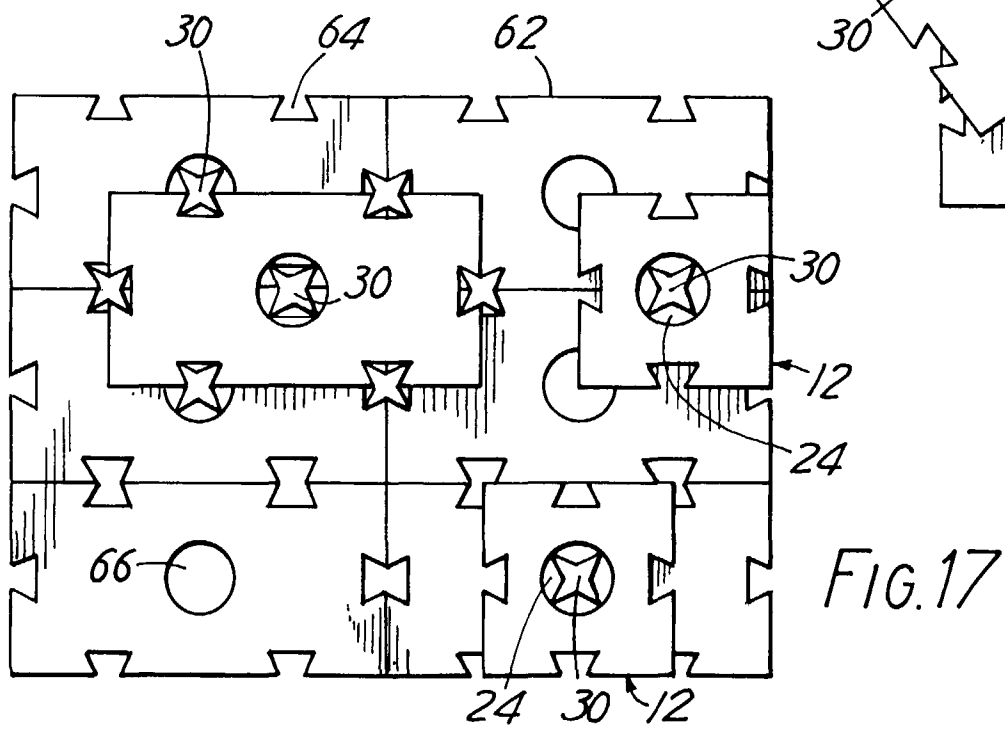
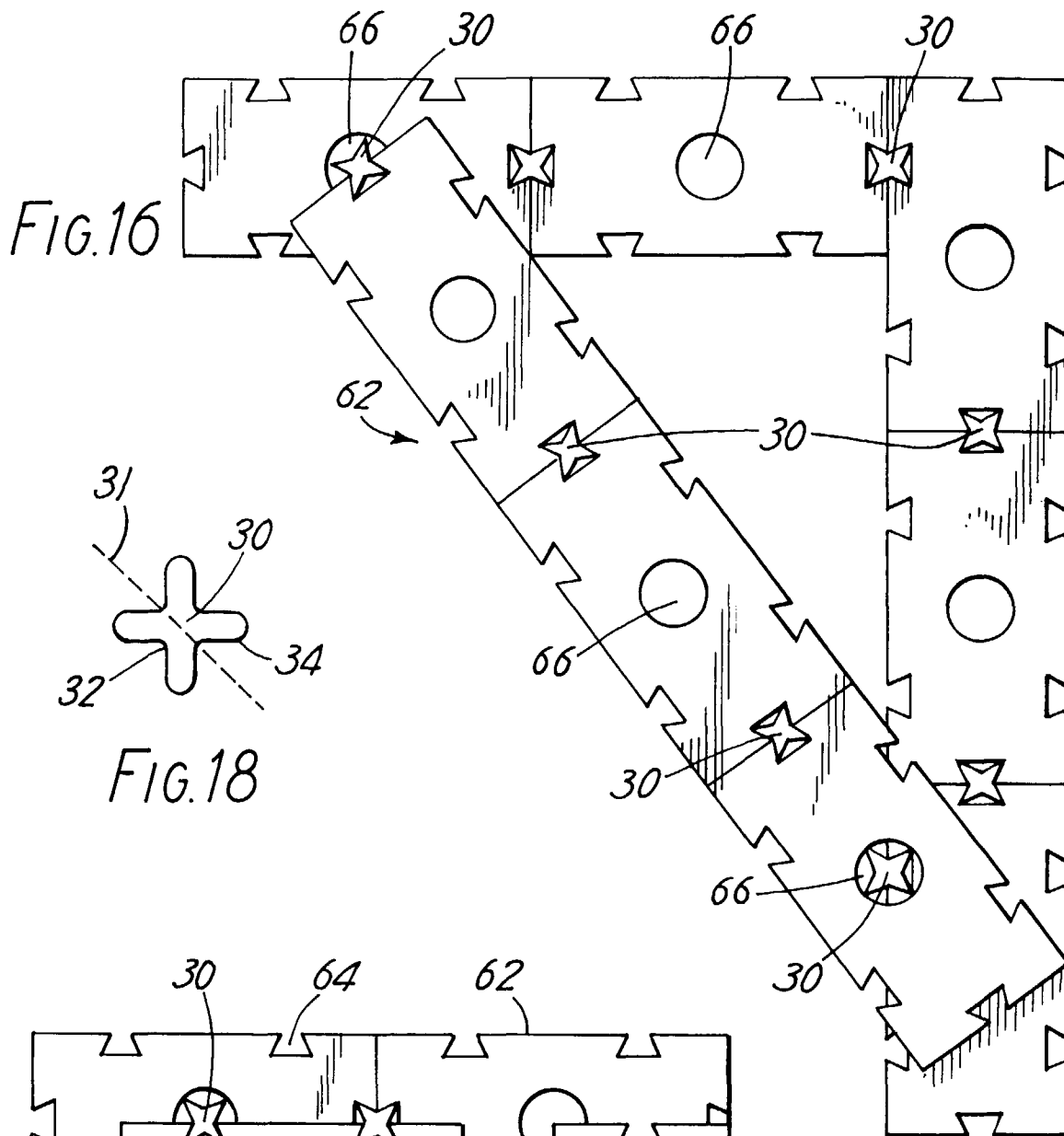
connected by said side surfaces.

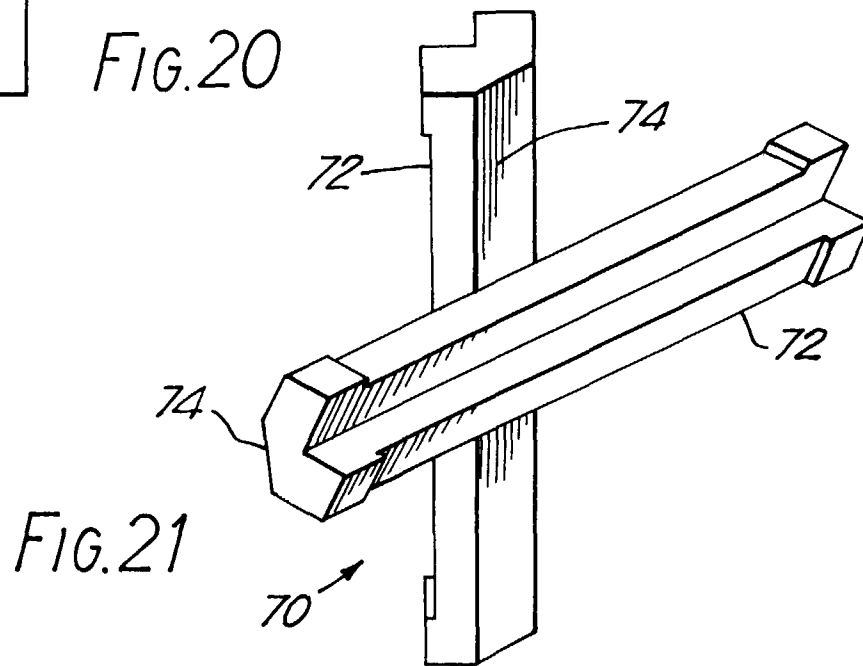
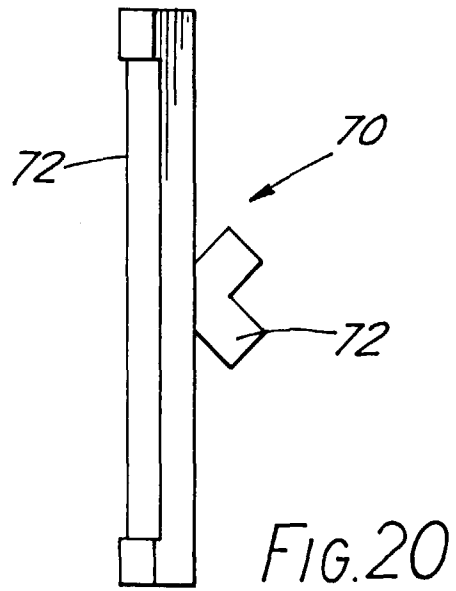
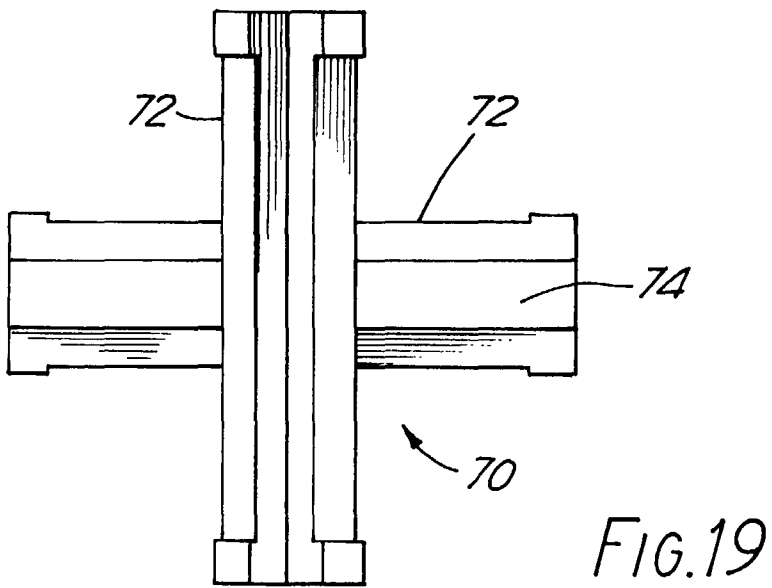
4. A constructional toy as claimed in claim 3, wherein each of said side surfaces extends perpendicularly to said ends.
5. A constructional toy as claimed in claim 3 or claim 4, wherein the main elements are all hollow, with one of said planar ends closed and the other open.
6. A constructional toy as claimed in any preceding claim, wherein the main elements and the connecting elements are made in a plurality of heights, of which the greater heights are integral multiples of the smallest height.
7. A constructional toy as claimed in any preceding claim, wherein the points of the star-shape of the cross-section of the connecting element are rounded or squared.
8. A constructional toy as claimed in any preceding claim, wherein the side surfaces of each point are made substantially parallel to each other, whereby to render the star-shape substantially cruciform.
9. A constructional toy as claimed in any preceding claim, wherein each groove is shaped to be substantially complementary in cross-section to the cross-sectional shape of any two adjacent points of the star-shaped cross-section of the connecting element.
10. A constructional toy as claimed in any preceding claim, wherein the grooves have slight indentations at each end thereof, which co-operate with complementary slight projections provided at each end of the connecting elements on each star point of their cross-sectional shape.
11. A constructional toy as claimed in claim 10, wherein the connecting elements have further slight projections, similar to the firstmentioned projections but of twice the length, at their midpoints, again on each star point of their cross-sectional shape, for co-operating with said slight indentations.
12. A constructional toy as claimed in any preceding claim, wherein said main elements and said connecting elements are moulded in a plastics material selected from ABS, acrylic plastic, polystyrene and polypropylene.

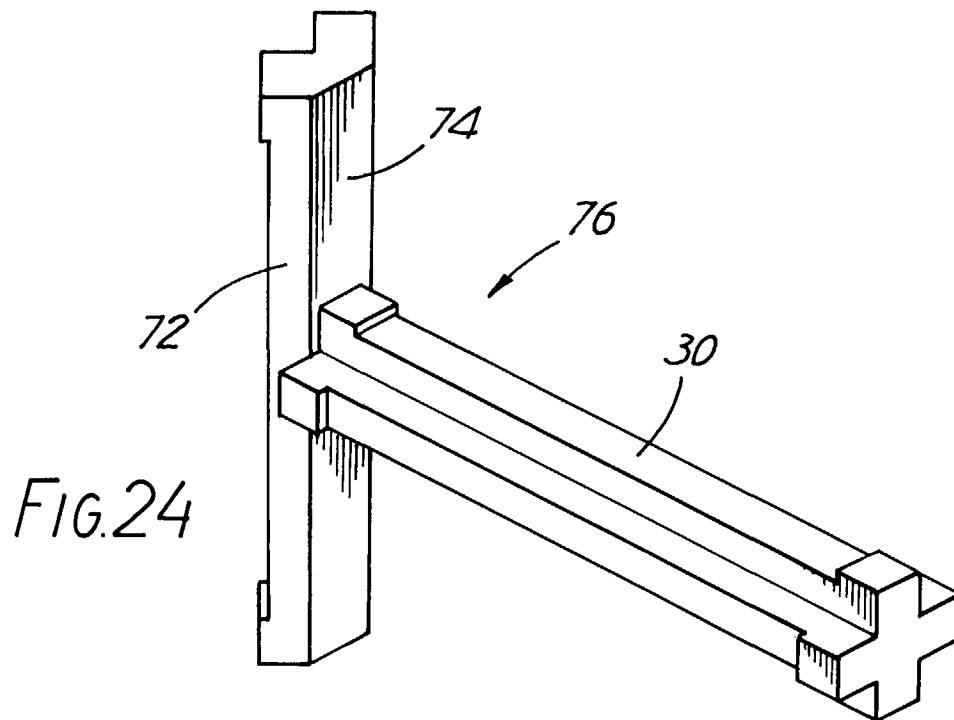
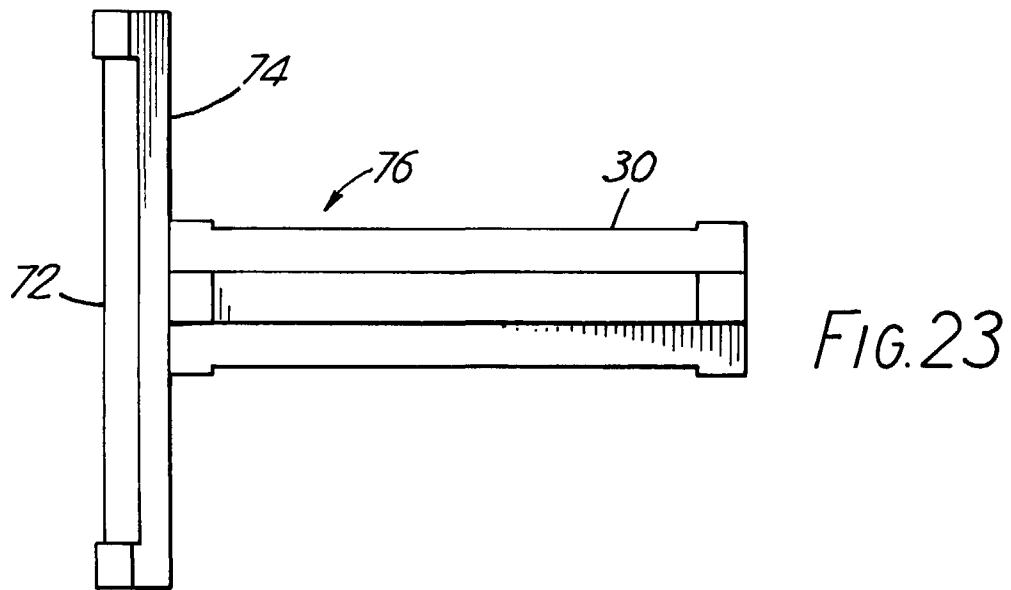
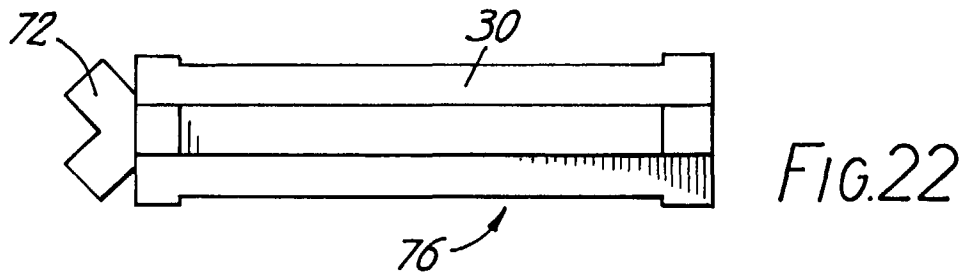












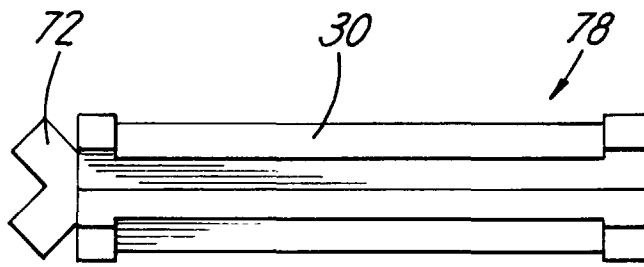


FIG. 25

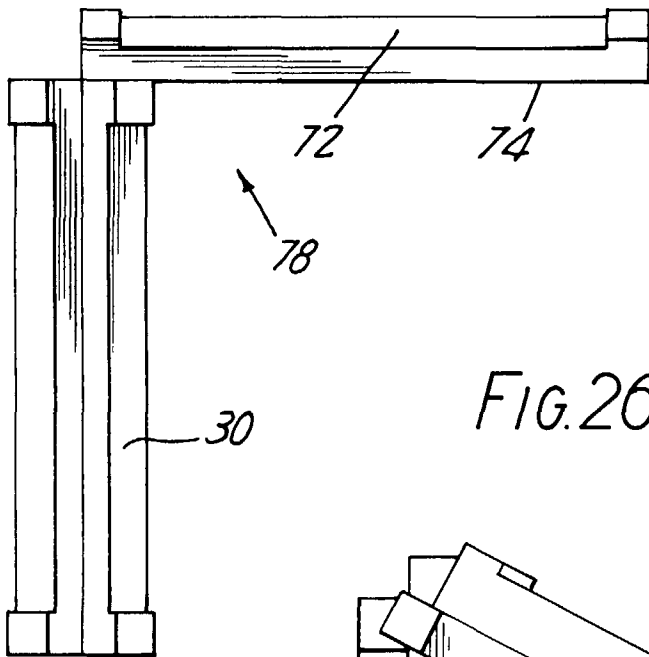


FIG. 26

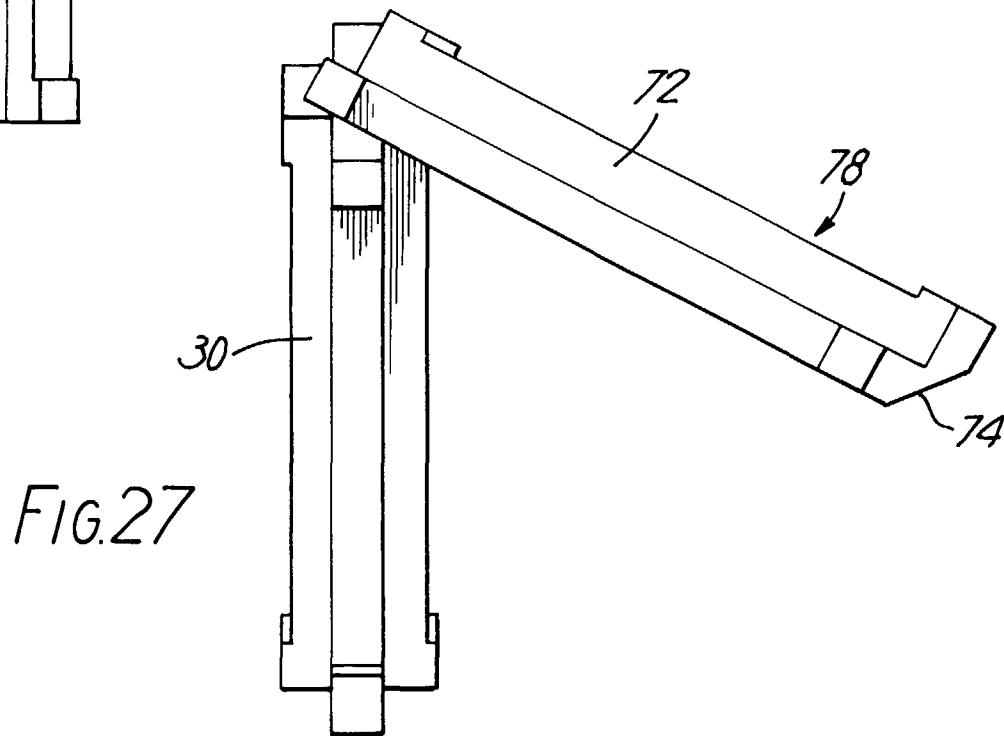


FIG. 27

