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(54) modular construction toys

(57) Panel, suitable for use in modular toy constructions, having a rectangular basic form with a body, a bottom side, a top side and two upright sides, which panel along at least one of the upright sides at a first distance therefrom is provided with holes situated at a second distance from each other, for attaching a connecting element, and is provided with slits running at right angles to the upright sides at the level of the holes, hinge, suitable for attaching such panels to each other, said hinge consisting of two halves, each comprising a leaf and a shaft part, the leaf being provided with a threaded rod-shaped projection, and nut, suitable for attaching such a hinge and having a convex head in which at least three recesses, situated near the edge of the head and together forming a grip for at least two fingers and a thumb, are present, and construction system consisting of the abovementioned elements.

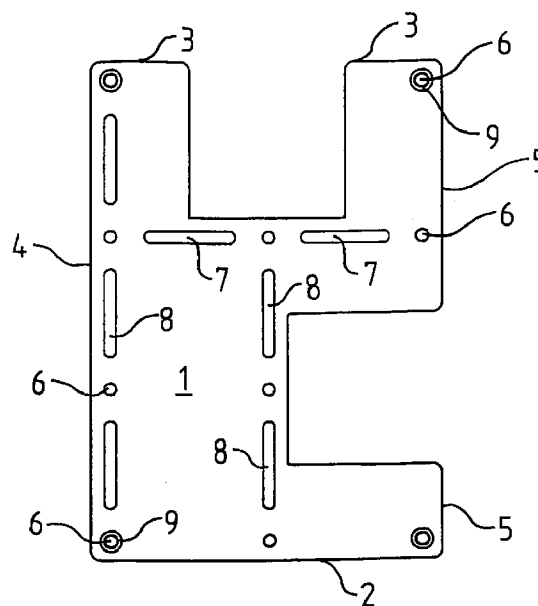


Fig. 1

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Description

The invention relates to a panel, suitable for use in modular toy constructions.

NL-A-81.03807 discloses rectangular panels which are provided with holes along the sides, by means of which the panels can be hingedly connected to each other in pairs, by means of straps, to form a windbreak. This construction must be held upright by tension wires and is not suitable for the fitting of floor or roof elements or for extension otherwise to form a toy house type of construction.

US-A-4,212,130 discloses panels which can be assembled by means of flexible strips to form a castle type of playhouse. This system does provide the possibility of fitting a roof, but only a small number of panels which are precisely defined as regards shape and dimensions can be used. Moreover, the construction is not simple for children to build.

FR-A-2,640,153 discloses a system in which corrugated board panels of many different shapes, and having bolt and nut connections, can be attached to each other by means of fold-over flaps present along the periphery of the panels. The chosen type of construction is geared entirely to the use of corrugated board, and is not clearly transferable to other materials.

EP-A-534,058 discloses a system for building playhouses in which panels are attached as a wall, roof or floor element to fixed upright elements in the form of concrete plinths or load-bearing wall parts. The elements of this system are not suitable for children to handle, and the use of the fixed upright elements as the basis means that there is little possibility of moving a play house built with these elements.

The object of the invention is then to provide an element which can serve as the basis for a flexible building system for modular toy constructions which can be used in many different forms, can be handled by children, and with which a self-supporting structure which is not restricted to one place can be produced.

This object is achieved according to the invention through the fact that the panel has a rectangular basic form, with a body, a bottom side, a top side and two upright sides, which panel along at least one of the upright sides at a first distance therefrom is provided with holes situated at a second distance from each other, for attaching a connecting element, and is provided with slits running at right angles to the upright sides at the level of the holes.

The panels can be interconnected by means of connecting elements which are attached to the panels by means of bolts through the holes. The connecting element is preferably a hinge, so that the panels can be hingedly connected to each other. Making use of the slits, floor panels and upper floors can be fitted, and these then provide further connections between the various panels, in addition to the connecting elements or hinges, and thus increase the rigidity of the construction, possibly even to the extent that fewer connecting

elements will suffice. Roof elements can also be attached using the slits or the holes, but also by means of other constructions known for that purpose, for example bolts and nuts.

A panel in this connection should be understood as meaning a flat or curved sheet whose thickness is essentially the same over the entire surface. Recesses, projections, thickened parts or narrowed parts may be present locally. For instance, the panel can be provided on one or both surfaces with decorations, for example vertical or horizontal grooves or ridges which give the impression of, for example, palings or masonry. Openings can also be provided in the panels, for example serving as door or window openings.

The basic form of the panel according to the invention is a rectangle. This should be understood as meaning that the panel can be a full rectangle, but also that the panel can be imagined as having originated from a rectangle from which parts have been removed, possibly both from the bounding sides and from the centre part. However, the rectangular nature is always apparent from the holes and slits pattern which is present in the panel and will be described below. The panel can also be a curved rectangle, for example in the form of a part of a cylinder wall, as described above. When the term side is used below, this should be understood as meaning not only a physical boundary of a rectangular panel, but also the imaginary side - lying in line therewith - of the rectangle from which the panel can be imagined as having originated through removal of material.

The size of the panel is geared to the envisaged use as a construction element in, for example, a toy house, castle or boat in which children can stand upright or slightly bent. The height of the largest panels can be up to 3 m, preferably up to 2 m, while 1.8 m has been found to be a practical size. Smaller panels of a size up to 0.8 m or 1 m can be used for parts of a toy construction which are not roofed. A lower limit may be imposed by the requirement that it must be possible to attach the panel to another panel, for which at least two holes must fit on the panel at the distance specified below, for attaching connecting elements at the required distances from each other. The panels may be produced in other dimensions if desired, for example as a scale-model construction system. Above and below we have always indicated the dimensions applying for use in a construction in which children can play. For production on a reduced scale, these dimensions can be reduced proportionately.

The side of the panel resting on the ground when the latter is accommodated in a play construction is described as the bottom side. In order to obtain optimum support and stability, said side is preferably straight or - analogous as regards function if the panel is curved - situated entirely in one plane, in particular the plane at right angles to the two upright sides. The bottom side can be partially interrupted by, for example, a door opening.

The panel is provided with holes along the upright sides at a first distance therefrom. By means of said holes, and by means of bolts and nuts, connecting elements, in particular hinges, can be attached to the panel, and panels can be (hingedly) interconnected by means of the connecting elements. The holes are situated at a first distance from the upright side in the panel body. Said distance is selected in such a way, depending on the dimensions of the hinges used, that so much space is left between the upright sides of two connected panels that the possibility of, for example, hands becoming trapped when the panels swing on hinges relative to each other is prevented. For a good connection between two panels, at least two holes are preferably present along each upright side. The holes are preferably disposed at the same second fixed distance from each other, hereinafter called the pitch, a first hole being present at a fixed distance from the bottom side. Such standardized measurements ensure that any panel can be connected to any other panel when the bottom sides of all panels are situated in one plane. A hole is preferably present at the same distance from the top side as the distance of the first hole from the bottom side. The selection of these fixed distances between hole and bottom and top side and between individual holes means that the height of a panel, i.e. the distance from the bottom side to the top side, is preferably a whole number of times the pitch plus twice the distance between hole and bottom or top side.

The holes are round or square and can also be in the form of slotted holes, the width of a slotted hole then preferably being equal to the diameter of the round holes or the side of the square. The requirements set for the position of the holes relative to the upright sides then apply for the part of a slotted hole situated closest to the upright side and corresponding to said round or square hole. Several rows of holes can be present, with regular distances between the holes situated along the upright sides, preferably at distances equal to the pitch n or $1/n$ times said pitch, n being a whole number. This ensures that in the centre plane of the panels it is also possible to attach elements to the panel, for example with bolts and/or nuts. Both in the direction parallel to the upright sides and at right angles thereto, the pitch is between 30 and 60 cm, preferably between 35 and 50 cm. The distance from the holes to the upright sides is between 10 and 15% of the pitch, 5 cm having been found a suitable distance. In the case of curved panels said distances are measured along the axis of the panel. The centre distance between the holes is preferably a whole number of times the pitch. In order to permit a sturdy attachment of the panels to each other, said centre distance along the upright sides is preferably just once the pitch.

An upright side can be completely straight, but openings of any size and shape can also occur therein, provided that sufficient material is present at the position of the holes in order to attach a hinge firmly thereto. For example, an undulating upright side, in which the

top of an undulation is always situated at the position of a hole, is conceivable.

The fourth side of the panel, which has not yet been discussed, is the top side. Said top side can be straight, but it can also be undulating or curved, for example adapted to the shape of a roof element which is intended to be supported by the panel. This means that the two upright sides can differ in length. The shape of the top side is preferably selected in such a way that at least two, and preferably at least three, holes are present in both upright sides. Going beyond the hole highest up, the panel can be extended by decorative elements which lie outside the basic form of the rectangle. Provisions can be made on or at the top side for fixing a roof.

Slits, running at right angles to the upright sides at the level of the holes, are present in the panel according to the invention. Said slits will be indicated below as horizontal slits. The distance between the slits is equal to the pitch or a multiple thereof. Each slit begins at a certain distance from a hole situated at the same height, so that a quantity of material is present between slit and hole, in order to provide the necessary strength of the panel. The length of the slits is not critical, but longer slits give more freedom for attaching elements. A limitation is imposed on the length of the slits by the requirement that sufficient material must be present between the end of a slit and an adjacent hole to ensure the required strength. The same also applies to the distance of a hole from the edge of a panel. Depending on the material selected, the person skilled in the art can easily calculate the minimum quantity of material which must be present between hole and slit, and thus the maximum length of a slit or the extreme position of a hole. Two separate slits lying in line with each other can also be present. A hole of a third row possibly present then lies between the two slits. The width of said slits is preferably equal to the diameter of the holes or to the width of the slotted holes, if present. This means that the same bolts which are usable for attaching the hinges can be used for attaching elements in the slits. Elements with pins or strips fitted thereon can also rest in the slits. The holes and slits are preferably recessed, so that countersunk screws can be used for better positioning and a greater bearing surface. In addition to the abovementioned horizontal slits, vertical slits running at right angles thereto can be present. These slits are preferably situated between the rows of holes along the upright sides, the distances between the successive rows of holes and slits always being the same. The requirements for the dimensions are the same as those for the horizontal slits.

The slits can be used for suspending objects from the panels serving as walls. Hook-shaped constructions which are known per se can be used for this purpose. Floor elements can be provided along their periphery with projecting edges which fit in the slits. For the attachment, these edges can be provided with threaded ends or holes with internal screw thread, onto which

screws, preferably screws of the type which will be described further below, are screwed from the nearer side of the panel. Use can also be made of pins which are inserted through the slits into holes in the floor element and fix the floor element to the panel by way of a snap-in connection. If the floor element is fixed adequately against shifting by the projecting edges, it is unnecessary to provide additional fixing by, for example, bolts and nuts.

Curved panels can be of any curved shape. Semi-circular or quadrantal panels are very suitable. Semi-circular panels can be constructed from two quadrantal panels, which are then preferably provided with holes on one upright side, and along the other sides are provided with means for connecting the panel to another panel provided with interacting means. Quadrantal panels can also be provided with holes on both sides, so that they can be interconnected by means of hinges or a corresponding connection. The construction of curved panels from several parts gives the advantage that, owing to their smaller opening angle, these component parts can be stacked more advantageously as regards space and can be manufactured by a simpler production technique. The invention also relates to a preferably quadrantal panel which is provided at one side with parts alternately projecting and receding over the same distances, the thickness of each part being half the thickness of the panel, and one surface thereof coinciding with the centre of the panel, and in which the projecting parts at the end furthest away from the panel bear a thickened part on the abovementioned surface, and the receding parts at the end closest to the panel have a recess in the abovementioned surface, the dimensions of which correspond to those of a thickened part on a projecting part. Such a panel can be connected in a simple manner to a complementary panel, in which the projecting and receding parts and the recesses and thickened parts are of corresponding dimensions, but lie staggered relative to the first panel.

A flat part can be provided between a projecting and a receding part, and a thickened part or recess can extend only over part of the height of the part concerned. In general, the construction can be designed with projecting and receding parts which differ from each other in thickness, length and/or height, provided that the complementary parts of panels which are to be connected to each other match each other. However, the thickened parts and recesses preferably extend over the entire height of the part concerned, unless the latter is one of the parts ending at the bottom or top side. As regards these last-mentioned parts, they preferably do not have a recess or thickened part near the bottom side or top side of the panel, so that when the panels are interconnected the connecting construction is not visible from the outside. The recesses and thickened parts are preferably the same height, and an equal number of both is preferably present. If equal dimensions are selected as far as possible for receding and projecting parts, and for thickened parts and recesses,

and these are distributed at regular intervals over the upright side, the advantage is achieved that a panel equipped in this way forms its own complementary panel when it is placed upside down. This means that a semi-circular panel, for example, can be assembled from two identical quadrantal panels, which is an advantage as regards construction and production.

The same construction can be used for flat panels, although in this case a space gain is not achieved when stacking, as in the case of curved panels.

The invention also relates to a hinge, suitable for attaching panels according to the invention to each other, said hinge consisting of two halves, each comprising a leaf and a shaft part, the leaf being provided with a threaded rod-shaped projection.

The conventional hinges are composed of two halves, each consisting of a leaf and a shaft part. The shaft parts are generally connected therein by a pin. This pin can be present on one of the shaft parts, while the other shaft part then has a hole in which the pin can be accommodated. Both shaft parts can also have an opening, through which two openings a separate pin is then inserted. Each leaf contains one or more holes, through which the leaf can be fixed by means of a screw or bolt to one of the parts to be hingedly connected. The hinge according to the invention differs from the known hinges through the fact that a projection by means of which the hinge can easily be positioned in a previously made hole is present on the leaves. In this already fixed state, the leaf, and consequently the hinge, can then be fastened to the object in which the hole is situated, by screwing on a suitable nut from the other side of the object. This simplifies the attachment of the hinge, so that such attachment can also be carried out by children, whose motor system is still less finely developed. When two panels are being connected, one of the projections of a hinge is inserted through a hole in a panel, following which a nut can be screwed on from the other side. The screw thread on the projection can be either internal or external, and can be provided either on the entire periphery or on only a part thereof. The nut then, of course, has a suitable complementary screw thread. If the projection is provided with an external screw thread, the external periphery of the projection is an at least partially rounded shape. If the projection is provided with an internal screw thread, the external periphery can also be a shape other than round, provided that the projection fits in the hole - preferably with slight play - through which it is to be fixed. At the position where it is fixed to the leaf, the projection preferably merges into a conical thickened part which fits in the recessed part of the holes in a panel, and in this way ensures good centring.

The attachment to the second panel to be connected is carried out in a corresponding manner. For connecting two panels rigidly to each other, the connecting element used can be a strip of material, for example metal or plastic, on which two rod-shaped projections have been fixed at the desired distance from

each other. Such a strip can be straight or bent, in the latter case the panels forming an angle with each other after the strip has been fitted.

The hinge is preferably designed in such a way that when panels connected by it swing on their hinges relative to each other the space between the facing upright sides of the panels cannot become less than 12 mm, preferably 15 mm, which prevents fingers from becoming trapped when the panels are swung on their hinges. This can be achieved by, for example, limiting the maximum angle through which the hinge can turn, or by forming a stop by means of a lug on the hinge leaf. The nut by means of which the hinge is attached to the panel is preferably provided with a convex head which is of such convex shape that, in the mutual position of the panels in which the nuts face each other, the stop is formed by the two heads going against each other. At least three recesses, situated near the edge of the head and together forming a grip for at least two fingers and a thumb, are preferably present in the convex head of the nut. This means that the nut can be tightened by hand. The external diameter of the head is designed for the envisaged manual tightening and therefore lies between 20 and 100 mm, preferably between 40 and 80 mm. For tightening the nut more tightly than hand-tight, an accessory was found, with a, for example, rod-shaped grip which has at one end a cavity in which the convex head of the nut fits precisely, and in which thickened parts fitting precisely in the recesses are present at the places corresponding to the recesses.

The diameter of the shaft part is preferably 10 -20 mm greater than the thickness of the panels which are attached by it, and the leaf is attached to the shaft part in such a way that the plane in which the leaf is situated preferably does not intersect the shaft part, or only just intersects it. Any line of intersection preferably lies at least 2/3 of the radius of the shaft part away from the centre point thereof. This ensures that the hinge sits between the panels and keeps the panels away from each other over a large part of the turning range; which is advantageous for preventing fingers from becoming trapped.

The rod-shaped projection is disposed at right angles to the plane of the leaf at the same side of the leaf as the shaft part, and is preferably situated on a conical raised part which fits in the recessed part of the holes in the panels.

The invention also relates to a construction system for toys, comprising panels, hinges and nuts of the type described above.

The invention will be explained with reference to the figures which follow, but it is not restricted to the exemplary embodiments illustrated.

In the drawings, Fig. 1 is a front view of a rectangular panel with recesses in the top side and in an upright side, and having holes and slits;

Fig. 2 is a front view of a panel with curved top side and various openings;

Fig. 3 is a front view of a panel, where a decorative element is present above the top side;

Fig. 4 is a front view of a quadrantal panel, having at one side edge projecting and receding parts for connection to another panel;

Fig. 5 is a rear view of the panel of Fig. 4;

Fig. 6 is a section along the line A-A in Fig. 5;

Fig. 7 is a section along the line B-B in Fig. 5;

Fig. 8 is a section of two connected panels according to Fig. 4, for the right-hand part at the position of the line A-A, and for the complementary left-hand part at the position of the line B-B of Fig. 5;

Fig. 9 shows a half of a hinge according to the invention, viewed at right angles to the lengthwise direction of the rod-shaped projection;

Fig. 10 shows the same hinge half, viewed in the lengthwise direction of the rod-shaped projection;

Fig. 11 shows a hinge according to the invention, composed of two halves according to Figs. 9 and 10;

Fig. 12 shows a side view of a nut for fixing a hinge according to Figs. 9 and 10 in a panel according to the invention;

Figs. 13 and 14 show a top and bottom view respectively of the nut of Fig. 12.

In Fig. 1 the panel as a whole is indicated by 1, and the bottom side, the top side and the two upright sides are indicated by 2, 3, 4 and 5 respectively. The holes are indicated by 6, and the horizontal and the vertical slits by 7 and 8 respectively. The holes on the corners of the panel are recessed by means of a conical ring 9. In the figures which follow and in the remainder of this figure, for the sake of simplicity and readability, the holes, slotted holes and slits are generally indicated as not recessed. In Fig. 2 a number of openings in the panel are indicated by 10. The top side 3 of the panel is curved. The holes highest up are situated at the same distance from the top side as the holes lowest down are from the bottom side. Two pins 11 projecting from the top side are present for attaching a roof element. Said pins are provided with the same screw thread as the hinges and can be fixed with the same nuts as said hinges. In Fig. 3 the top side is no longer distinguishable as such, because it is accommodated in the decorative element of the panel which suggests a palm tree. At least three holes 6 are present along each upright side, in order to permit a sturdy connection with another panel. In Fig. 4 the holes are in the form of recessed slotted holes 12. Projecting parts 13a and 13b with thickened parts 14a and 14b can be seen on upright side 5. The bottom projecting part 13b has a part 15b not provided with a thickened part, the bottom boundary of which coincides with the bottom side 2 of the panel. The distance between the projecting parts 13a and 13b is essentially equal to the height of these parts. Some clearance for the purpose of fitting is present. The distance of the top side of projecting part 13a from the top side 3 of the panel is equal to the height of projecting

part 13b, including part 15b.

In Fig. 5, which shows the other side of the panel from Fig. 4, receding parts can be seen between the projecting parts 13a and 13b and above the top projecting part 13a, in which receding parts recesses 16b and 16a, corresponding in dimensions to the thickened parts 14a and 14b, are present. Complementary to the flat part 15b of projecting part 13b, recess 16a also does not continue to the top edge. The imaginary plane through the lines 17a and 17b coincides with the centre of the thickness of the panel, so that the thicknesses of the projecting parts 13a and 13b and of the wall 18a and 18b of the panel are equal at the position of the receding parts. This can be seen in detail in Figs. 6 and 7. The panel as shown in Figs. 4 and 5 is consequently complementary to an identical panel placed upside down, and two of such panels can be connected to form a semi-circular panel by means of the system of projecting and receding parts and recesses and thickened parts shown. In Fig. 6, 13a is a projecting part with thickened part 14a.

In Fig. 7, 18b is the panel wall at the position of the receding part, in which the recess 16b has been cut out. The thickness of the wall at the position of 18b is equal to half the thickness of the panel body 1. Reference number 19 indicates the additional part of the panel which is present at the position of a projecting part and is not present at the position of a receding part, and in which the part beyond the dotted line forms a projecting part 13b, as can be seen in Fig. 6. It can be seen in Fig. 8 how, when the system is connected, thickened part 16b is accommodated in recess 14a, and the parts 13a and 18b connect fully to each other. It is pointed out that the left panel is positioned upside down relative to the right panel, with the result that sections A-A and B-B coincide.

In Fig. 9 the leaf of the hinge half is indicated by 20, and 21 is the shaft part which is in the form of a hollow bush with bottom 22. A rod-shaped projection 23 with external screw thread 24 is present on the leaf 20. Plate 25 forms the connection between the leaf 20 and the shaft part 21. The projection 23 is placed on a conical raised part 26 which fits into the recessed part 9 of a hole 6 of the type shown in Fig. 1 and ensures good positioning of the hinge half in a hole in a panel according to the invention. Fig. 10 shows the same hinge half, viewed in the lengthwise direction of projection 23. The remaining reference numbers signify the same as in Fig. 9. In Fig. 11 a hinge is composed of two halves according to Fig. 10, one half being rotated through an angle of 180° in the plane of the drawing. The shaft parts 21a and 21b are internally connected to a common body which fits into the shaft parts in a tight fit. This is indicated by dotted lines in Fig. 11. If desired, the body can be provided with, for example, compressible, resilient parts which hook into projections which can be disposed in the inside of the hollow shaft parts 21a and 21b. Fig. 12 shows a nut 30 with a convex head 31 and threaded part 32, which projects from below the head

and is provided with reinforcing ribs 33. The threaded part is provided on the inside with screw thread which fits on the external thread of rod-shaped projection 23 of a hinge half according to Figs. 9 and 10. The convex head 31 is provided with recesses 34 in which thumb and fingers can be placed, in order to tighten the nut. The reference numbers in Figs. 13 and 14 have the same meaning as in Fig. 12.

Claims

1. Panel, suitable for use in modular toy constructions, which has a rectangular basic form, with a body, a bottom side, a top side and two upright sides, which panel along at least one of the upright sides at a first distance therefrom is provided with holes situated at a second distance from each other, for attaching a connecting element, and is provided with slits running at right angles to the upright sides at the level of the holes.
2. Panel according to Claim 1, which along both upright sides at said first distance therefrom is provided with holes situated at said second distance from each other, for attaching a connecting element.
3. Panel according to Claim 1, provided at one side edge with parts alternately projecting and receding over the same distances, the thickness of each part being half the thickness of the panel, and one surface thereof coinciding with the centre of the panel, while the other surface coincides with an external surface of the panel, and in which the projecting parts at the end furthest away from the panel bear a thickened part on the abovementioned surface, and the receding parts at the end closest to the inside of the panel have a recess in the abovementioned surface, the dimensions of which correspond to those of a thickened part on a projecting part.
4. Hinge, suitable for attaching panels according to Claims 1 - 3 to each other, said hinge consisting of two halves, each comprising a leaf and a shaft part, the leaf being provided with a threaded rod-shaped projection.
5. Nut, suitable for attaching a hinge according to Claim 4, having a convex head in which at least three recesses, situated near the edge of the head and together forming a grip for at least two fingers and a thumb, are present.
6. Accessory for tightening a nut according to Claim 6, comprising a cavity which fits on the head of the nut and the inside of which is provided with raised parts which fit in the recesses of the nut.
7. Modular construction system, comprising panels,

hinges and nuts according to one of Claims 1 - 5.

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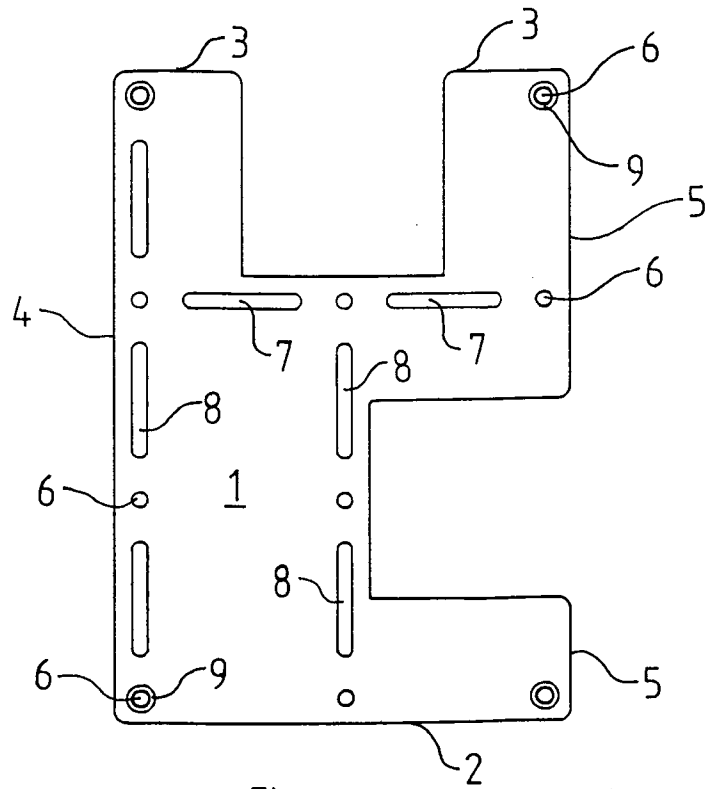
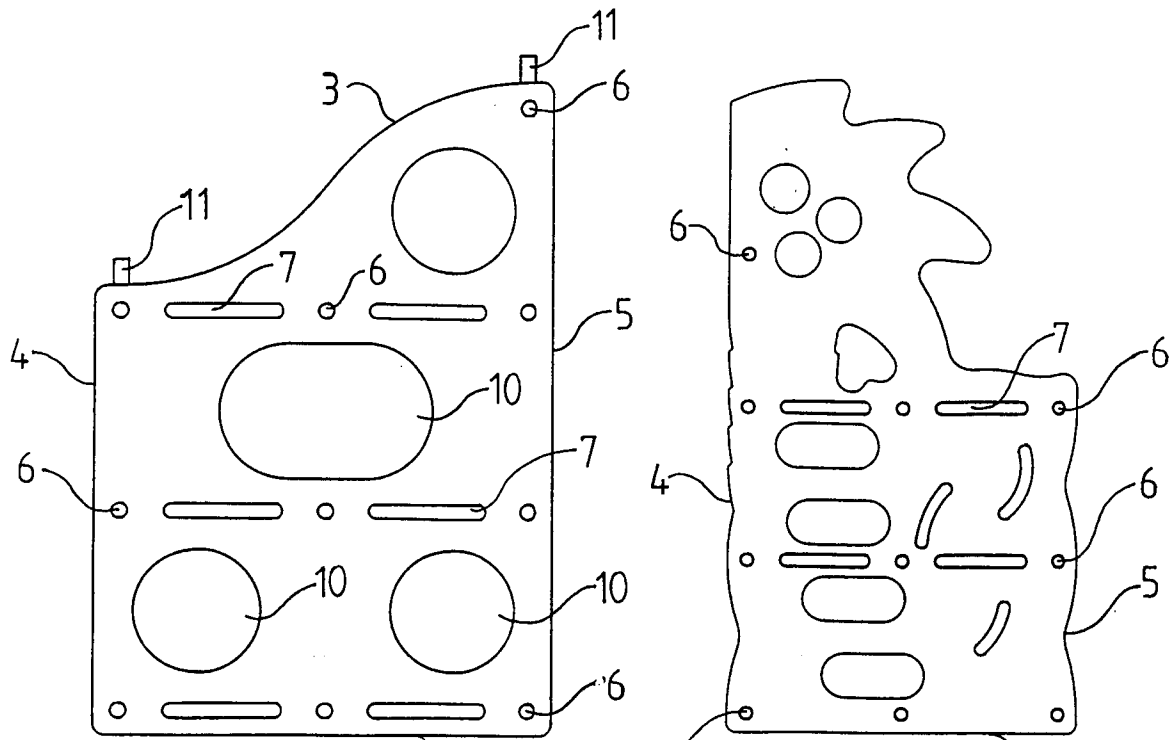
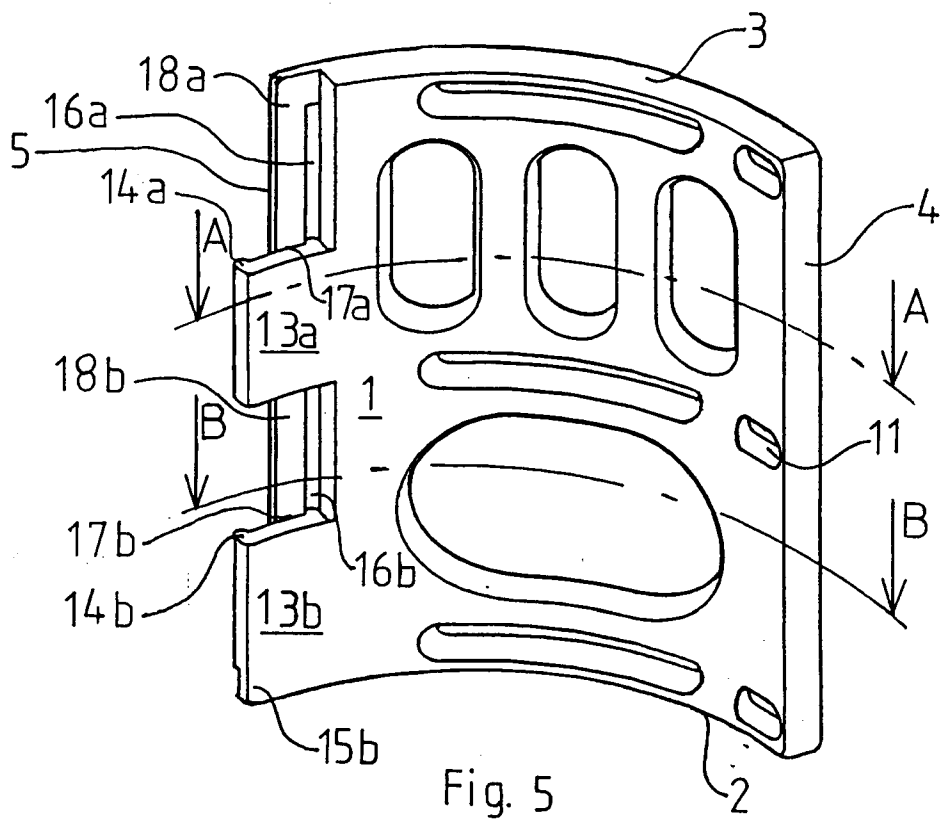
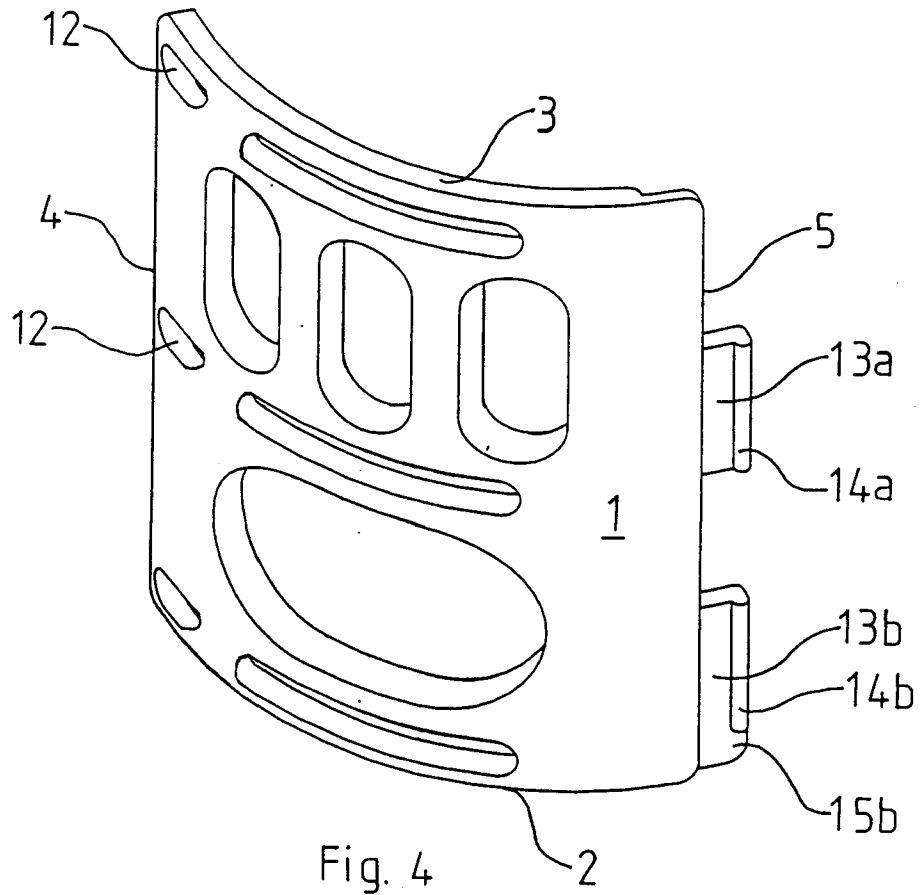
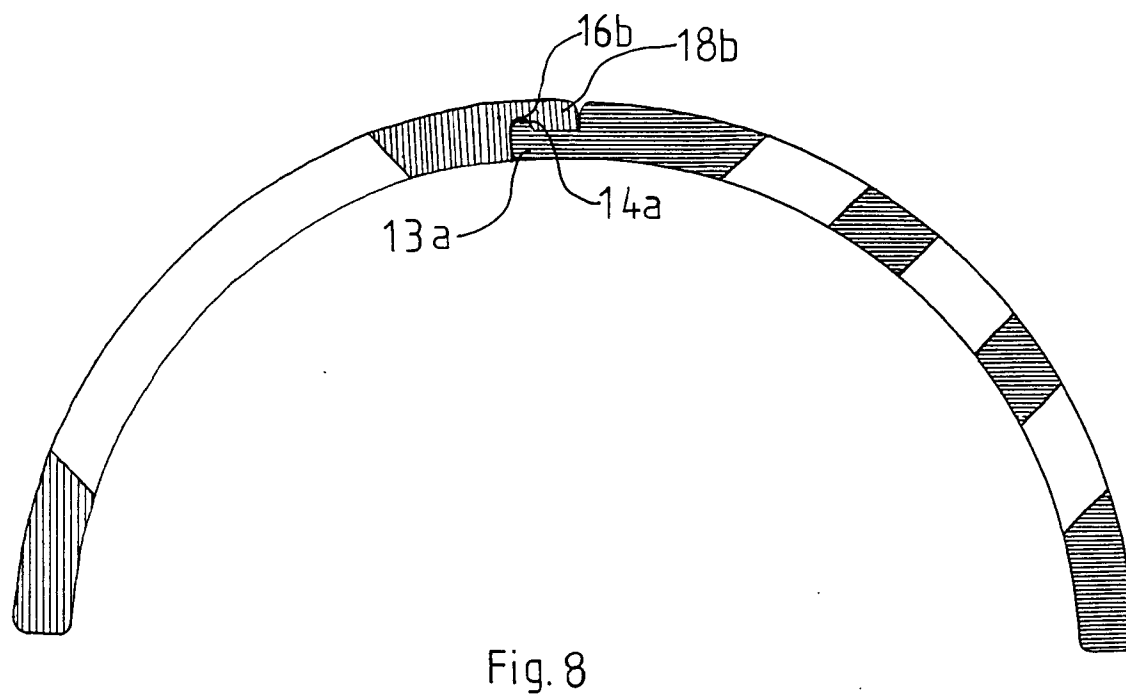
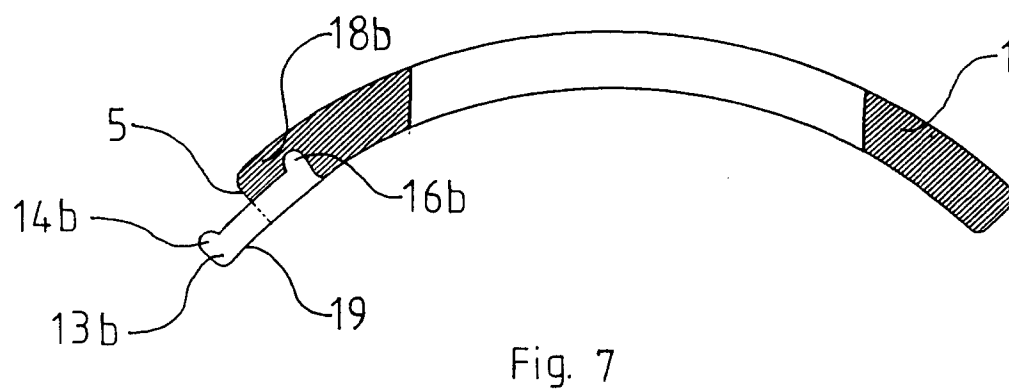
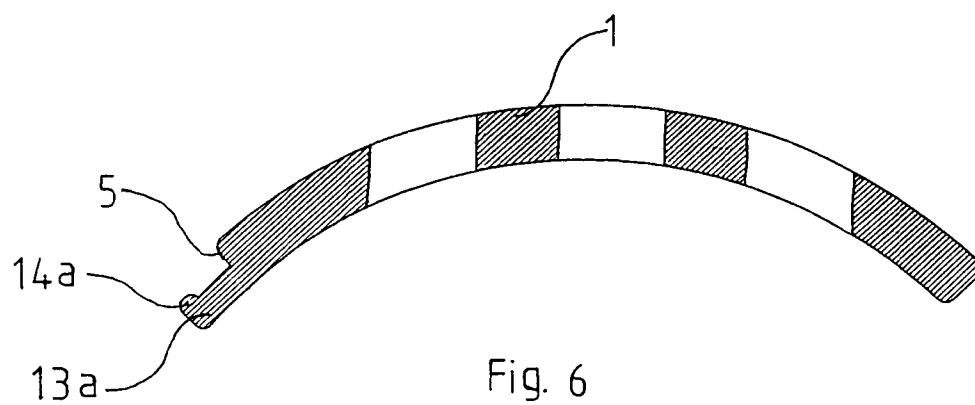


Fig. 1







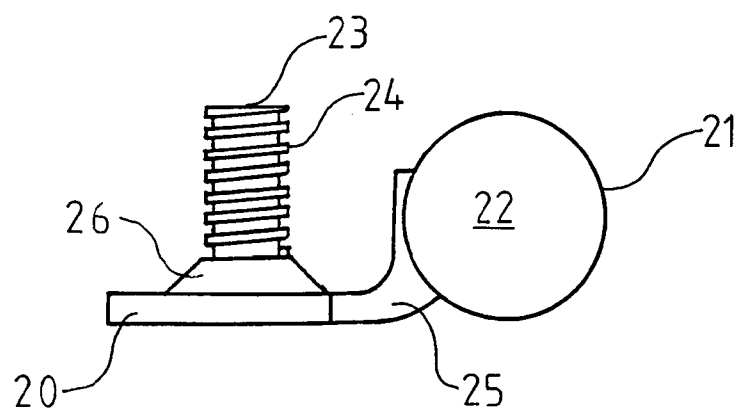


Fig. 9

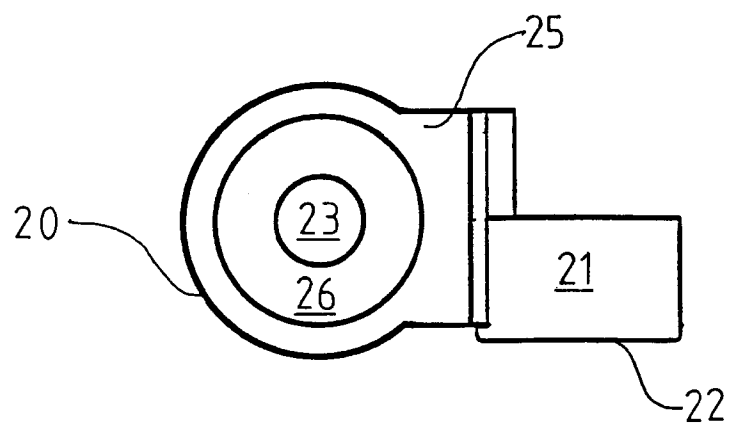


Fig. 10

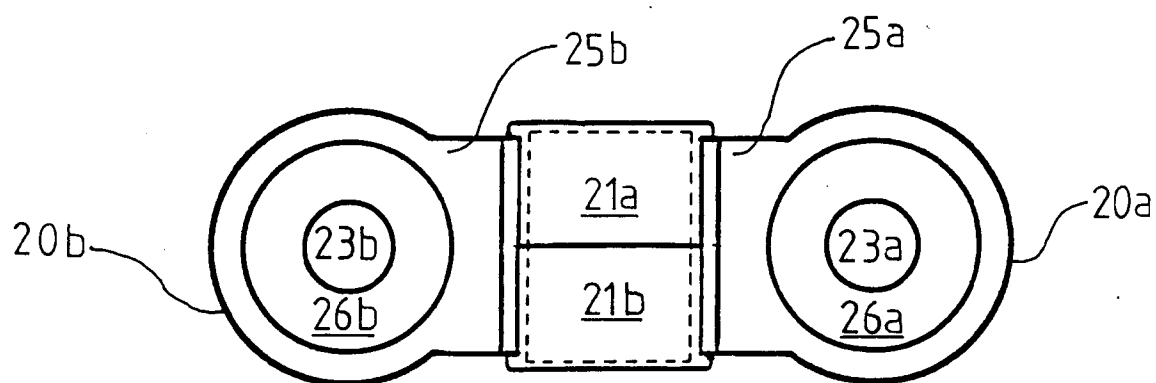


Fig. 11

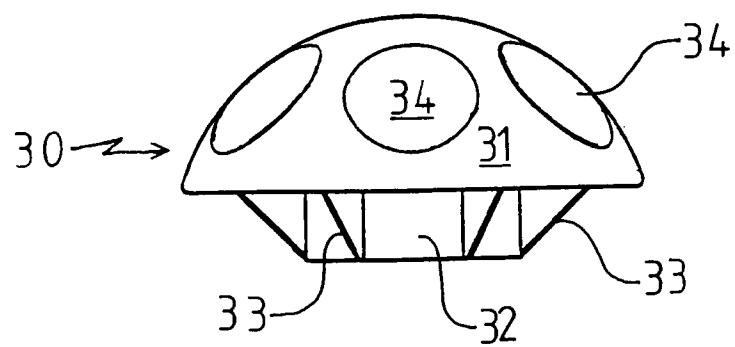


Fig. 12

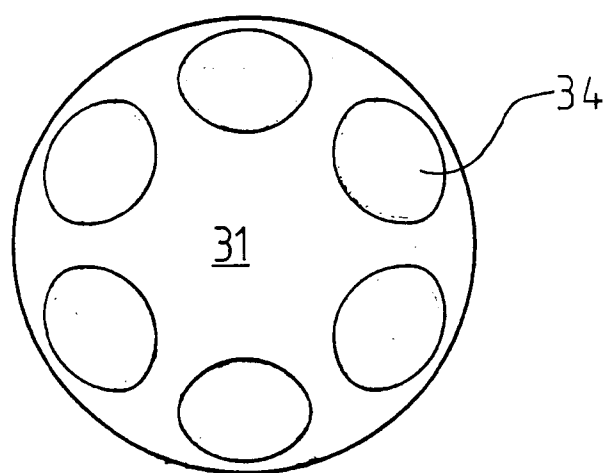


Fig. 13

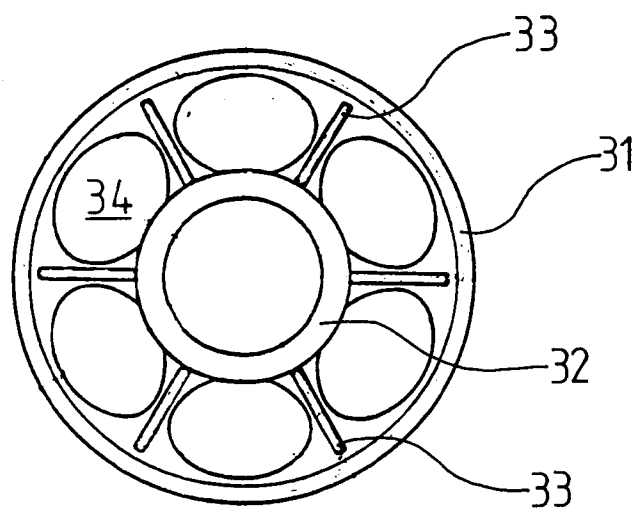


Fig. 14