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Location devices for reinforced concrete walls

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2011253576 22 Nov 2011

Abstract

The invention concerns location devices for the interconnection of building blocks and/or support of reinforcement rods in a concrete wall. The invention provides a location device 140 to align one or more building blocks comprising two members 142 spaced apart by cross members 144. Positioning means 138 is provided on an outer face of at least one cross member 144 formed to help align a second building block to be positioned above a first building block to be fitted with the location device (as shown in Fig. 21). The invention also concerns a wall and a method of building a wall using the location device.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

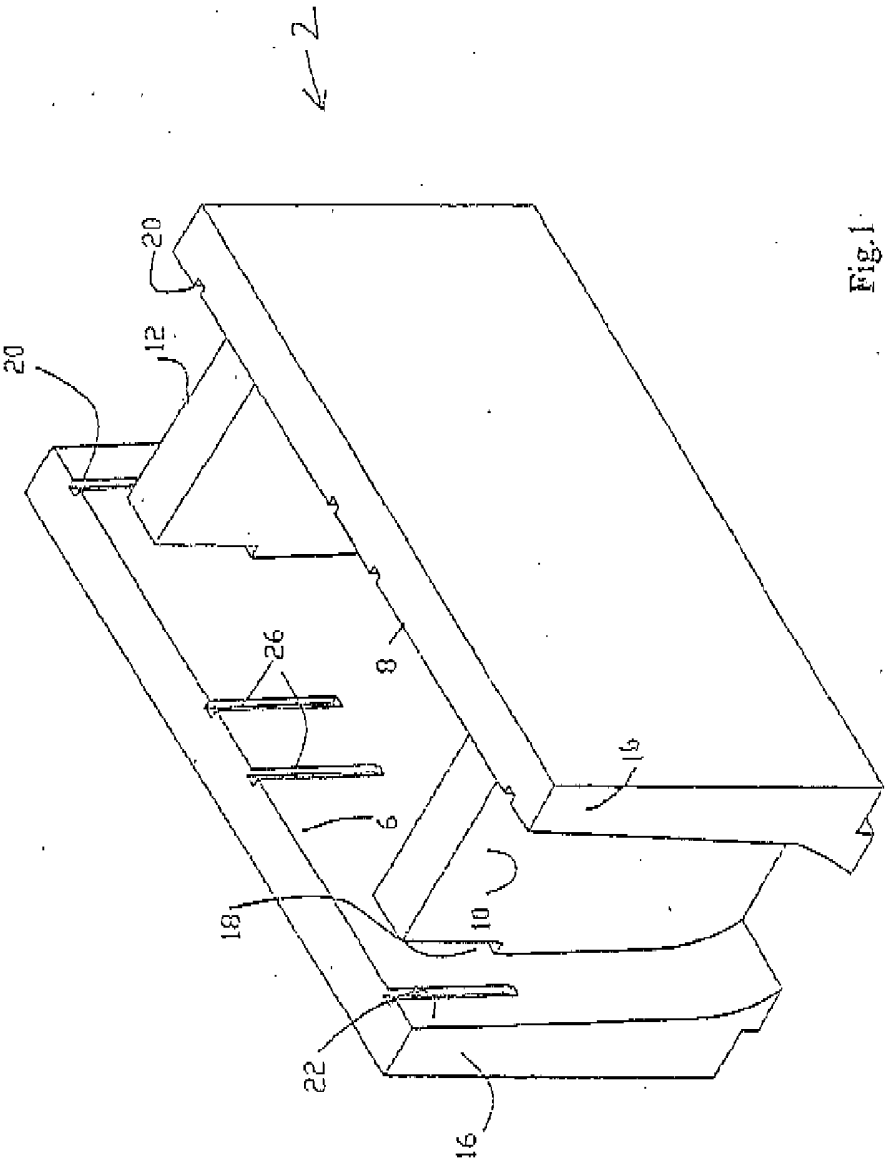


Fig.1

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

Title

LOCATION DEVICES FOR REINFORCED CONCRETE WALLS

Technical Field

The invention concerns location devices for the interconnection of building blocks and/or support of reinforcement rods in a concrete wall comprised of building blocks. The invention also concerns a wall comprised of building blocks and location devices, and a method of building such a wall.

Background Art

Known hollow building blocks are used to make reinforced concrete walls. In general these blocks are laid using staggered bond to ensure a good connection and to provide shear strength between the blocks. The hollow core of the wall is then filled with vertical steel reinforcing rods and concrete grout. A problem arises in aligning the blocks using staggered bond since they are not made with uniform height. Therefore, mortar is used between the blocks to accommodate this difference in height.

In order to eliminate mortar, Australian Patent No 692868 proposes the use of blocks having slotted ends, and keys to lock the ends of the blocks together. Additional courses are then added in stack bond, and the keys extend between adjacent courses so that each key locks four blocks in place. In the resulting structures there are vertically extending hollow voids to receive reinforcing steel and concrete. However, it is difficult to provide for horizontally arranged steel or horizontal concrete flow in such a wall.

Disclosure of the Invention

In a first aspect, the invention provides a location device to align one or more building blocks comprising two members spaced apart by cross members, and positioning means provided on an outer face of at least one cross member formed to help align a second building block to be positioned above a first building block to be fitted with the location device.

The positioning means may be sized to abut a top surface of the first building block, and to abut the bottom surface of the second building block. Further, the positioning means may comprises a ledge. The ledge act as a platform and is formed to hold the second building block positioned above the first building block at a correct height despite discrepancies in the height of the first building block.

The members and the cross members may define at least one vertical cavity.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

The location device may further include a bottom member spanning the area between the two members and cross members, the bottom member defining a circular aperture.

The location device may further comprise at least one pair of vertical projections on the top of the members which may be formed to receive a reinforcing rod parallel to the cross members. Further vertical projections may be provided so that the reinforcing rods can be positioned at varying distances from the cross members, so that the correct distance can be selected. The vertical projections click the steel reinforcement rods into position so that the rods then holds the blocks together and in correct alignment.

The location device may be made with a resilient material so that the location device is flexible. With such a construction, the location device can be easily fitted into place by pressing on the cross members together, and then releasing once in position. The resilient material may be water resistance so as to form a membrane down the space between two blocks layed end to end to inhibit water penetration.

The extensions to the members may form a straight line, alternatively the extensions of the members beyond the cross members may on different planes, with the members positioned closer together.

The blocks interconnected by the location device may be arranged in a stagger bond or stack bond formation.

In addition, the location device may provide guide means for guiding an inner face of a building block when placing it in position on top of a building block fitted with the location device. The guide means may include the upper end of the extension of the two members beyond the cross members and may also include ribs provided on the outer face of the cross members above the ledge.

The location devices may also be used in a wall comprised of the building blocks and location devices described above, and arranged in either stack or stagger with the location devices interconnecting the building blocks. The interconnection of the blocks may be as described above.

The invention may also be used in a method of constructing a reinforced concrete wall comprising the above described building block and location device.

Brief Description of the Drawings

Examples of the present invention will now be described with reference to the accompanying drawings, in which:

FIG. 1 is perspective view of a first building block.

FIG. 2 is a plan view of the first building block.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

FIG. 3 is a plan view of a variant of the first building block, for use at the corners or ends of a wall.

FIG. 4 is an end view of the building blocks of FIGs. 1, 2 and 3.

FIG. 5 (a), (b) and (c) are perspective, plan and side views respectively of a first location device for use with the building blocks of FIGs. 1, 2, 3 and 4.

FIG. 6 is a perspective view showing the blocks of FIGs. 1, 2 and 4 and the location devices of FIG. 5 assembled together to form part of a wall.

FIG. 7 is a simplified plan view showing the blocks of FIGs. 1, 2, 3 and 4 and the location devices of FIG. 5 assembled together to form part of a wall.

FIG. 8 is an end view of three of the blocks of FIGs. 1, 2, 3 and 4 stacked one above another in a wall as shown in FIGs. 6 or 7.

FIG. 9 is a perspective view of a second building block.

FIG. 10 is a plan view of the building block of FIG. 9.

FIG. 11 (a) and (b) is a plan view of two variants of the building block of FIGs. 9 and 10 for use at corner locations, or for connecting at intermediate locations.

FIG. 12 is a perspective view of one of the building block of FIG. 11.

FIG. 13 is a sectional view of the building block of FIGs. 9, 10, 11 and 12.

FIG. 14 is a perspective view illustrating a second location device interconnecting two of the blocks shown in FIGs. 9 to 13.

FIG. 15 (a) and (b) are simplified end views of one of the second blocks and one of the second location devices before and after installation in the block.

FIG. 16 is a simplified plan view showing the second blocks and the second location devices assembled together to form part of a wall.

FIG. 17 is a perspective view showing more of the wall of FIG. 16.

FIG. 18 is a cross section through the wall of FIG. 17 showing horizontal reinforcing rod in the second location devices.

FIG. 19 is a detail showing an arrangement of a reinforcing rod at a corner of the wall of FIG. 16.

FIG. 20 is an X-ray view revealing the locations of the second location devices in two courses of the second blocks.

FIG. 21 is a detail of FIG. 20.

FIG. 22 is a perspective view of a third building block.

FIG 23 is a plan view of the third building block.

FIG. 24 is a perspective view of a third location device.

FIG. 25 is a perspective view of the third location device interconnecting two of the blocks shown in FIGs. 22 and 23.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

FIG. 26 is a plan view of part of a wall built using the third blocks and third location devices, and horizontally arranged reinforcing steel.

FIG. 27 is a side view of an x-rayed location device and three of the blocks of FIGs. 22 and 23 arranged as shown in FIG. 26 to form part of a wall.

FIG. 28 is a perspective view of FIG. 27.

FIG. 29 is a plan view of a variation in the arrangement of the third location device as shown in FIG 26.

FIG. 30 is a side view of three blocks of FIGs. 22 and 23 showing an x-rayed location device arranged as shown in FIG. 29 to form part of a wall.

FIG. 31 is a perspective view of FIG. 30.

FIG. 32 is a perspective view showing more of the wall of FIG. 28 with vertical steel reinforcement.

FIG. 33 is a perspective view of a modified third block.

Best Mode for Carrying Out the Invention

FIGs. 1 and 2 show a first building block 2 for use in building walls. Block 2 has two side panels 6 and 8 and open ends. The inside faces of the side panels 6 and 8 of the block are inclined to allow for easy release from the mould during manufacture. Bridging parts 10 and 12 span between side panels 6 and 8 adjacent respective ends. FIG. 3 shows a variant of the first building block 4 for use at the corners or ends of a wall. Block 4 has one bridging part 12 similar to FIG. 1, but the other end 14 is modified to close the end of the block. An intermediate bridging part 15 spans the middle of block 4. The vertically extending cavities formed between the panels and bridging parts of the blocks 2 and 4 allow for the vertical insertion of reinforcing rods and for concrete flow.

The blocks 2 and 4 are similar in size to a standard concrete block. However, unlike the standard block, at least one of the ends is open with the bridging part 10 or 12 positioned back from the ends 16 of the panels 6 and 8. Adjacent the recessed ends of the blocks, end slots 20 extend vertically down the inner faces 22 of the panels 6 and 8. The slots 20 are arranged in opposing pairs and are spaced a predetermined distance from the ends 16 of the panels. Moreover pairs of intermediate slots 26 extend vertically down the inner faces 22 of the panels 6 and 8 between the bridging walls. These pairs of slots are also formed in opposed sets of four at predetermined spacing along the inside faces 22 of the panels 6 and 8. The positioning of the slots 20 is determined so as to enable the blocks to receive a location device which will be described in detail later.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

FIG. 4 shows that the tops of the bridging parts 10, 12 and 15 are made in such a way as to allow them to be broken out. Apertures 18 extend approximately 80mm down from the top of panels 6 and 8 to define a removable section 17 which breaks away along the broken line 30. This allows the creation of a horizontally extending cavity inside a wall made using the blocks, that can accommodate reinforcing rods and concrete flow.

Furthermore in the block 4 of FIG. 3, deep grooves 28 are formed in the panels 6 and 8 and the end 14, to allow any combination of sections 24 to be broken out of the closed end or sides of the block. Removal of sections 24 enables horizontal insertion of steel reinforcing rods and concrete flow, and is useful depending on the location of the block, as will be described later.

As shown in FIG. 4, the blocks 2 and 4 are also formed with longitudinally extending stepped recesses 31 along the bottom 29 of the outer faces of the panels 6 and 8. The recesses 31 are large enough to receive an upper edges 32 of an underlying block, and provides a means for aligning the blocks and holding them in position.

FIGs. 5 (a), (b) and (c) show a location device 40. The location device 40 may be made of any suitable material to serve its purpose, in this case it is moulded in a plastics material. The location device 40 comprises two members 42 spaced apart by cross-members 44. The cross-members 44 are slightly inclined from the vertical so that they lean outwards. The ends 46 of members 42 extend beyond cross-members 44 and are on a different plane to the members, the members being positioned closer together. The extension of the members are sized to enter the slots 20 or 26 of the blocks 2 and 4. The length of the members 42 allows the device 40 to span between the side panels 6 and 8 of the building blocks 2 and 4. The length of the cross-members 44 allows the ends 46 of members 42 to enter a set of four slots 26, and a set of four slots 20 formed when two blocks are positioned end to end. Pairs of vertical projections 48 along the tops of members 42 are designed to receive steel reinforcing rods 50.

As shown in FIG. 6 a straight block wall 60 is constructed by laying blocks 2 end to end to each other without the aid of mortar. Between each pair of blocks is a perpendicular space, or joint, 62. The break out sections 17 of the bridging parts 10 and 12 are removed as required. The location devices 40 are then placed in position between each of the adjacent blocks, guided by the edges of the four extensions 46 which fit into opposing pairs of slots 20. The edges of extensions 46 are vertical, but could be slightly inclined to assist in their insertion if required. The inclined faces of the cross-members 44 of the location device 40 are manually forced down into the block, aligning with the sloping inside faces 22. Incidentally, when the block mould

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

wears, the inside of the block cavity or core diminishes in size. By having the end cross members 44 appropriately inclined, the location device 40 can still be inserted, but at a slightly higher position.

A more complex wall is shown in FIG. 7, where both blocks 2 and 4 are used to make a wall 60 with a corner 68 and an intermediate wall 70. In this case one or more of the break out sections 24 are removed from block 4 to form openings 71 and create horizontal channels around the corner 68 and between the intermediate wall 70 and wall 60. The resulting wall comprises a series of blocks 2 and 4 held together end to end by the location devices 40. Steel reinforcing rods 50 and 51 are then laid inside the wall channel, along its length, and are received between pairs of projections 48 in successive location devices 40. Each pair of projections 48 firmly clamp against the sides of 12mm deformed steel rods 50 and 51. Additional location devices 40 may be placed in slots 26 to provide additional support for the steel reinforcing rods 50 and 51.

When the blocks have been laid to the full length of the walls 60 and 70, and the reinforcing rods 50 and 51 have been clipped to the location devices 40 over the entire length of the walls 60 and 70, the rods 50 and 51 and the blocks 2 and 4 are locked together, making it extremely difficult to separate. But more importantly, the rods 50 and 51 are locked into the walls 60 and 70 at precisely the correct location stipulated by the building code, giving the wall great strength. Concrete grout may then be used to fill the wall, and it will flow horizontally along the block course and around the corners through the broken out sections.

When the next course is laid, the blocks are positioned on top of the laid layer in a similar manner. Moreover, the engaging recesses 31 along the bottom faces 29 of the blocks 2 and 4 are fitted over the upper edges 32 of the laid blocks 2 and 4 to facilitate alignment. In this case the bottom face 29 fits into the space above the top of the bridging walls 10, 12, 15. This is more clearly shown in FIG. 8, which illustrates the stacking arrangement.

Next is a description of a second example with reference to FIG. 9 through FIG. 21. FIG. 9 and FIG. 10 shows a second building block 102 for use at intermediate locations of a wall that has two side panels 106 and 108 with open ends. Bridging parts 110 and 112 span between the side panels 106 and 108 adjacent at respective ends.

Blocks 104 of FIGs. 11 and 12 show variants of block 102 for use at corners, intersections, or ends of walls. Block 104 is either a right or left block, each having a bridging part 112 at one end and the other end is closed 114. A further intermediate bridging part 115 is also provided. The right block 104 of FIG. 11 (a) has deep grooves 128 formed in panel 106 between the end 114 and bridging 115 parts of the block.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

Grooves 128 allows section 124 to be broken out to create horizontal cavities around corners or intersections of walls. The left block of FIG. 11 (b) and FIG. 12 is a mirror image of FIG. 11 (a) allowing section 124 to be broken out of side panel 108.

The blocks 102 and 104 are similar in size to a standard concrete block. At least one end is open with the bridging part 112 positioned back from the ends 116 of the panels 106 and 108. Pairs of protrusions 120 extend perpendicularly and vertically from the inside faces 122 at the ends 116 of the panels 106 and 108. These protrusions 120 replace the slots 20 of blocks 2 and 4 and enable the blocks to receive a location device which will be described in detail later.

As shown in FIG 13, like blocks 2 and 4, the bridging part 110, 112 and 115 can be broken out. Apertures 118 extend approximately 80mm down from the top of the panels 106 and 108 to define a removable section 117 which can break away along broken line 130. This allows the creation of a horizontally extending cavity inside a wall made using the blocks 102 and 104.

FIG. 13 also shows a modified form of the block 102 with curvature 125 at the base of the block which allows the steel mould to release the block during production. The top of the block is bevelled 126 to encourage the slurry or cement paste to travel between the two blocks 102 ensuring complete filling.

FIG. 14 shows a second location device 140 installed between two blocks 102 layed end to end. The location device 140 comprises two members 142 spaced apart by two cross members 144. The ends 146 of members 142 extend beyond the cross members 144 and are receive the protrusions 120 between them. The members 142 span the distance between opposing pairs of protrusions 120, and the cross members 144 extend the width of two adjacent protrusions 120.

Furthermore, a perpendicular ledge 138 is provided on an outer face of each cross member 144. The ledge 138 extends the width of the cross member 144. When the location device 140 is installed, the ledge abuts the top of the protrusions 120 and the bottom surface of ledge 138 abuts the top surface of protrusions 120. The ends 146 of the members 142 above the ledge 138 acts as a nudge lock to help position and hold the bottom of the protrusions 120 from the next course of blocks.

The location device 140 further provides pairs of vertical tapered projections 148 on the tops of members 142. These can receive up to three reinforcing rods of varying diameters which are clicked into position.

The construction of the location device 140 is made slightly resilient so as to allow a spring effect to hold the blocks 102 and 104 flush with one another when fitted. As shown in FIG. 15 (a) the locative device 140 can be installed by applying pressure to

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

the cross members 144 so that they are contracted slightly towards each other. The locative device 140 is then lowered inside the block 102 or 104 as shown in FIG. 14 (b). The pressure to the cross members 144 is released causing the cross members 144 to return to approximately their original position and clamp against the blocks 102 and 104 holding them firmly in place.

A method of constructing a block wall using blocks 102 and 104 and location device 140 will now be described with reference to FIG. 16 and FIG. 17. Initially, the job site is laid out and positions for the blocks 102, 104, doors and windows are marked and profiles installed in each corner for accurate height. Then a first course of blocks 102 and 104 are laid end to end without the aid of mortar. Between each pair of blocks is a perpendicular space, or gap 162 to allow for tolerance. The first course is laid to a height line forming a bed-joint 147 to bring the blocks to accurate height and length.

The location devices 140 are installed between pairs of blocks 102 and 104 in the manner shown in FIG. 15 at each end to end position 153 and at each corner or intersection 152.

Vertical steel reinforcing rods 155 are placed to protrude vertical upward from the centre of each block 102 and 104. The plan is checked after the laying of the first course, and if further horizontal support is required, lateral steel reinforcement 150 are placed into it. The steel reinforcement rods 150 also help to bring the blocks into alignment. The reinforcement steel 150 prevents the blocks to which the location device 140 is fitted from any movement until the total wall receives the insitu concrete.

The next course of blocks 156 is then placed directly on top of the blocks below in stack or stagger bond. Further courses are then laid and this is repeated until the desired height is achieved. As shown in FIG. 18, the laying of the next course of bricks are assisted by the location device 140. The formations 120 of the next course of blocks are positioned using the ledge 138, upper end of the cross member 144 and upper end 146 of the members 142 of the locative device 140 as a guide.

The step of checking for the need for additional horizontal support is repeated for each course layed. As the tapered projections 148 of the location device 140 provide three different positions for the placement of the reinforcing rods 150 there is choice is their placement. The cross section of FIG. 18 shows a possible arrangement of the horizontal reinforcing rods 150.

FIG. 19 shows a possible arrangement of a reinforcing rod for a corner of a wall. A corner steel bar 154 is introduced for extra reinforcement which helps to hold the corner 152 together.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

FIG. 20 illustrates another function of the location device 140 when placed between two courses of blocks 102 which are not each of uniform height. Non-uniform height of blocks is a common problem with dry stacked blocks. FIG. 21 shows details of the area inside the circle of FIG. 20. The blocks associated with the location device 140 are been labelled A, B, C and D. While block B is shorter than the correct height, the location device 140 compensates for this. The ledge 138 of the location device 140 is clamped on one side between blocks A and C by the top and bottom surface of their respective protrusions. This pressure supports the ledge 138 at the correct height on both sides despite block B's incorrect height. A gap 158 is created above block B, and block D is supported by the ledge 138 which is at the correct height ensuring that the wall maintains the correct level. Cementous paste will fill the gap 158 when the wall is complete.

Next is a description of a third example with reference to FIG. 22 through FIG. 32. FIG. 22 and FIG. 23 shows a third building block 202. The side panels 106a and 108a, bridging parts 112a and 110a, and protrusions 120a have a similar function to those of the second building block 102 of FIGs. 9 and 10 and for simplicity are referenced by the same reference numerals with subscript "a".

Additionally, block 202 has intermediate pairs of adjacent protrusions 220 on the inner sides of the side panels 106a and 108a. These allow the block 202 to hold a locative device, such as the locative device 140 of FIG. 14, at either the end or intermediate position of the block 202. Block 202 is designed for use in either stack or stagger pattern, and is provided with a lip 203 along at the top and side of one of the side panels 106a or 108a so to appear as a mortar line once laid.

FIG. 24 shows a location device 140a. The members 142a, cross members 144a, ledge 138a, ends of the members 146a and projections 148a have a similar function to those of the location device 140 of FIG. 14 and for simplicity are referenced by the same reference numerals with subscript "a". The location device 140a further provides guide means in the form of ribs 270 for guiding the inner surface of protrusions 120a and 220 when placing in position a course of blocks on top of the location device 140a. Furthermore, the location device 140a includes a bottom member 272 with a circular aperture to provide a more rigid construction while still allowing concrete and vertical steel reinforcing rods to pass through.

FIG. 25 and 26 show a possible arrangement of the location devices 140a installed in a straight wall constructed by laying blocks 202 end to end. The location devices 140a are positioned between each building block 202 clamped onto a pair of opposing protrusions 220 from each building block 202. The location devices 140a

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

support a reinforcement steel rod 150a which clicks into position bringing the blocks into alignment. As shown in FIG. 27 and FIG. 28, this arrangement of the location devices 140a enables a stagger bond pattern for the next course of blocks. Block B is staggered across A and C, with the location device 140a clamping the protrusions 220 of Block B. Here the lips 203 at the top and along one side appear as a mortar line. To lay a next course of blocks the location devices would be positioned on either side of block B, clamping on the protrusions 120a of block B and the protrusions 120a of adjacent blocks (not shown).

FIGs. 29, 30 and 31 show an alternate arrangement of the location devices 140a that also creates a stagger bond pattern. In FIG. 29 a first course of blocks is layed end to end with the location devices 140a fitted to the centre of each block, clamping onto the protrusions 220. The installation of the steel reinforcement rod 150 helps to align the blocks correctly. As shown in FIGs. 30 and 31, a next course of blocks is layed by aligning the base side of the protrusions 120a of block B against the ledge 138a, and the side of the protrusions 120a with the ends of the members 146a. Ribs 270 guide the inner side of the protruding portions 120a when placing the block B in position. To lay the next course of blocks a location device would be positioned in the middle of block B, clamping on the protrusions 220.

FIG. 32 shows more of the wall of FIGs. 26 and 29. The locative devices 140a can be fitted to the protrusions 220 or 120a of blocks 202, protrusions 120 of block 104, or are not fitted at all, depending on requirements for accurate location of the reinforcing rod 150a and the area of the wall. Part of the wall has vertical steel reinforcement rods 155 installed, and filled with concrete paste.

FIG. 33 shows an alternative block 302. This blocks has similar features to the block 102 of FIGs. 9 and 10, and the block 202 of FIG. 22, and similar parts are denoted by the same reference numerals with a subscript "b". Additionally, block 302 provides a pattern on the outer face 303 of a side panel 118b to give the appearance of a traditional stone block wall once laid.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A location device to align one or more building blocks comprising two members spaced apart by cross members, and positioning means provided on an outer face of at least one cross member formed to help align a second building block to be positioned above a first building block to be fitted with the location device.

2. A location device according to claim 1, where the positioning means is sized to abut a top surface of the first building block, and to abut the bottom surface of the second building block.

3. A location device according to claim 1 or 2, wherein the positioning means comprises a ledge.

4. A location device according to claim 3, where the ledge is formed to hold the second building block positioned above the first building block at a correct height despite discrepancies in the height of the first building block.

5. A location device according to any one of the preceding claims, where the members and the cross members define at least one vertical cavity.

6. A location device according to any one of the preceding claims, further comprising at least one pair of vertical projections on the top of the members formed to receive a reinforcing rod parallel to the cross members and between the cross members.

7. A location device according to any one of the preceding claims, where the location device is made with a resilient material so that the location device is flexible.

8. A location device according to claim 9, where the resilient material may be water resistant so as to form a membrane down the space between two blocks layed end to end to inhibit water penetration.

9. A location device according to any one of the preceding claims, where the members and the extensions to the members form a straight line.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

10. A location device according to any one of the preceding claims, where the blocks interconnected by the location device can be arranged in a stack bond formation.

11. A location device according to any one of claims 1 to 9, where the blocks interconnected by the location device can be arranged in a stagger bond formation.

12. A location device according to any one of the preceding claims, further comprising guide means for guiding an inner face of the second building block when placing it in position on top of the first building block.

13. A wall comprised of building blocks and a location device according to any one of the preceding claims.

14. A method of constructing a reinforced concrete wall comprising building blocks and location devices according to any one of claims 1 to 14, comprising the steps of:

laying a first course of the blocks to a height line forming a bed-joint to bring the blocks to an accurate height and length, the blocks layed end to end without the aid of mortar;

as required, placing location devices between blocks at the ends of the side panels and/or at a corner of the wall and/or between ends of the side panels;

as required, removing the removable sections of the blocks and fitting lateral steel reinforcement rods to the location devices;

repeating the steps of laying a further course of blocks above of the laid course, placing location devices and fitting lateral steel reinforcement rods as required until the desired height of the wall is created; and

filling the blocks with concrete grout as required.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

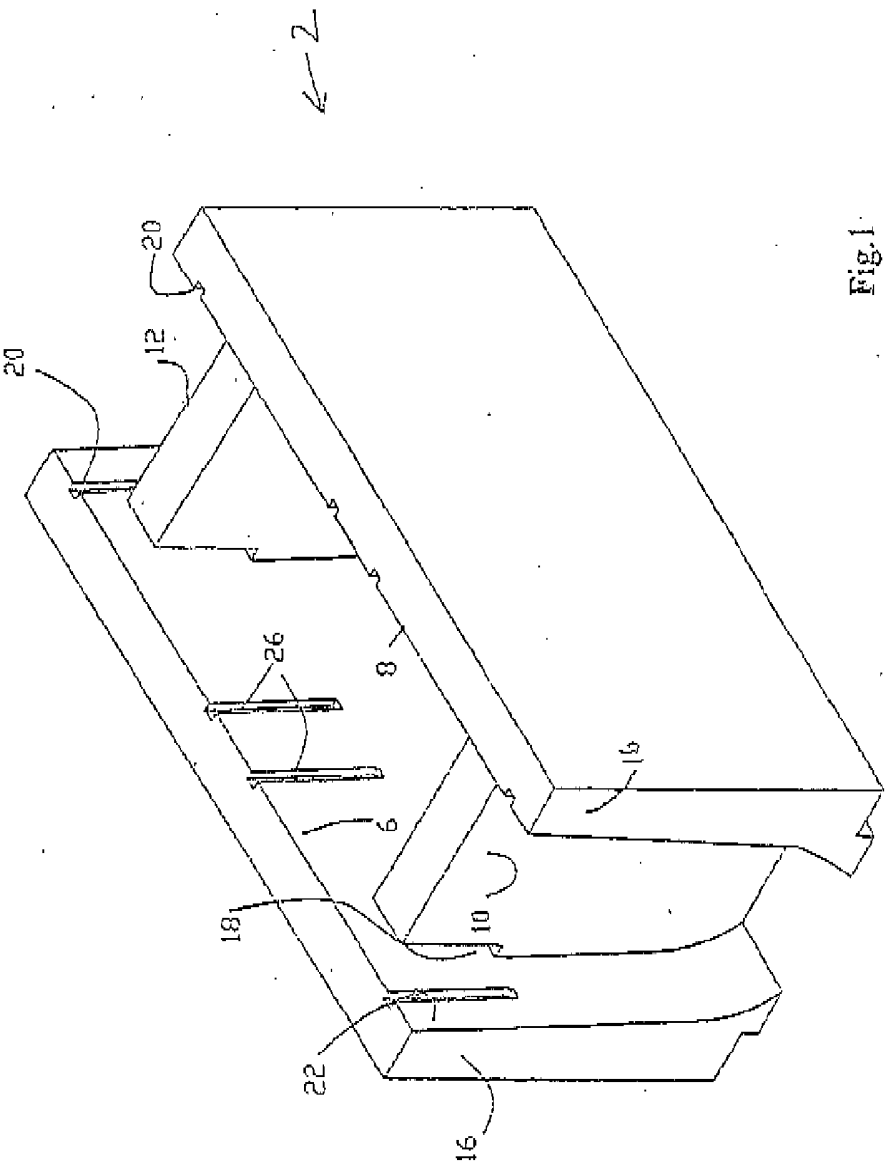


Fig.1

2011253576 22 Nov 2011

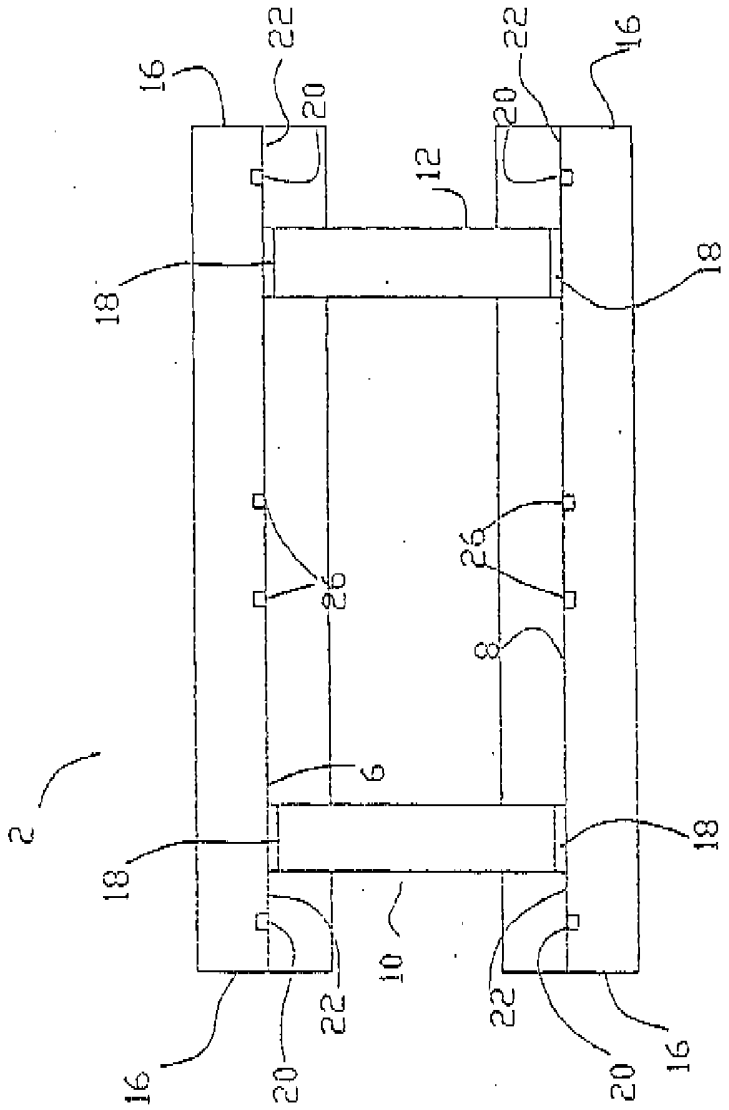


FIG.2

2011253576 22 Nov 2011

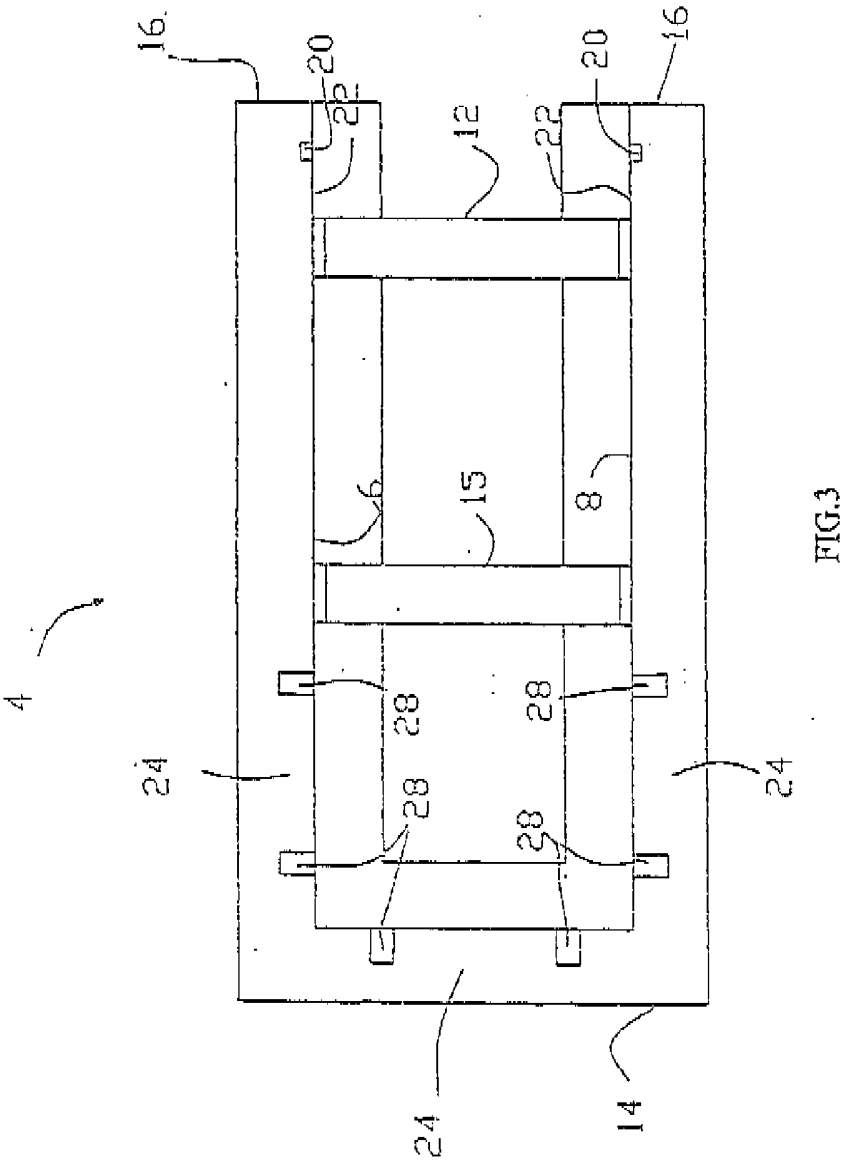


FIG.3

2011253576 22 Nov 2011

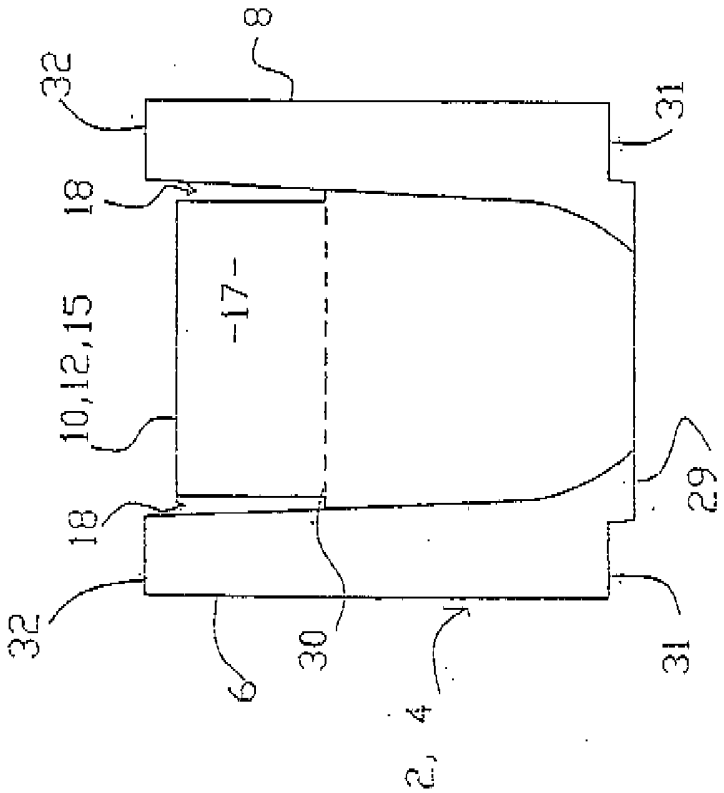


FIG.4

2011253576 22 Nov 2011

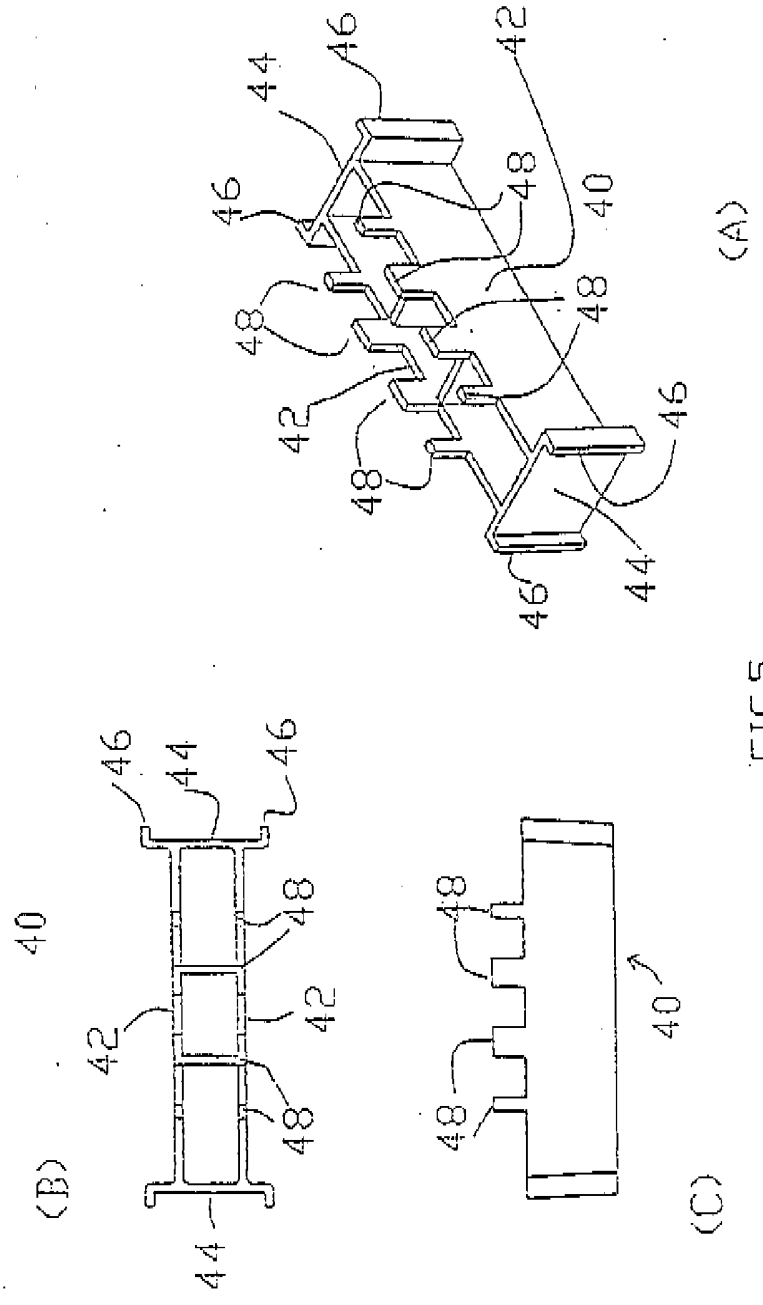
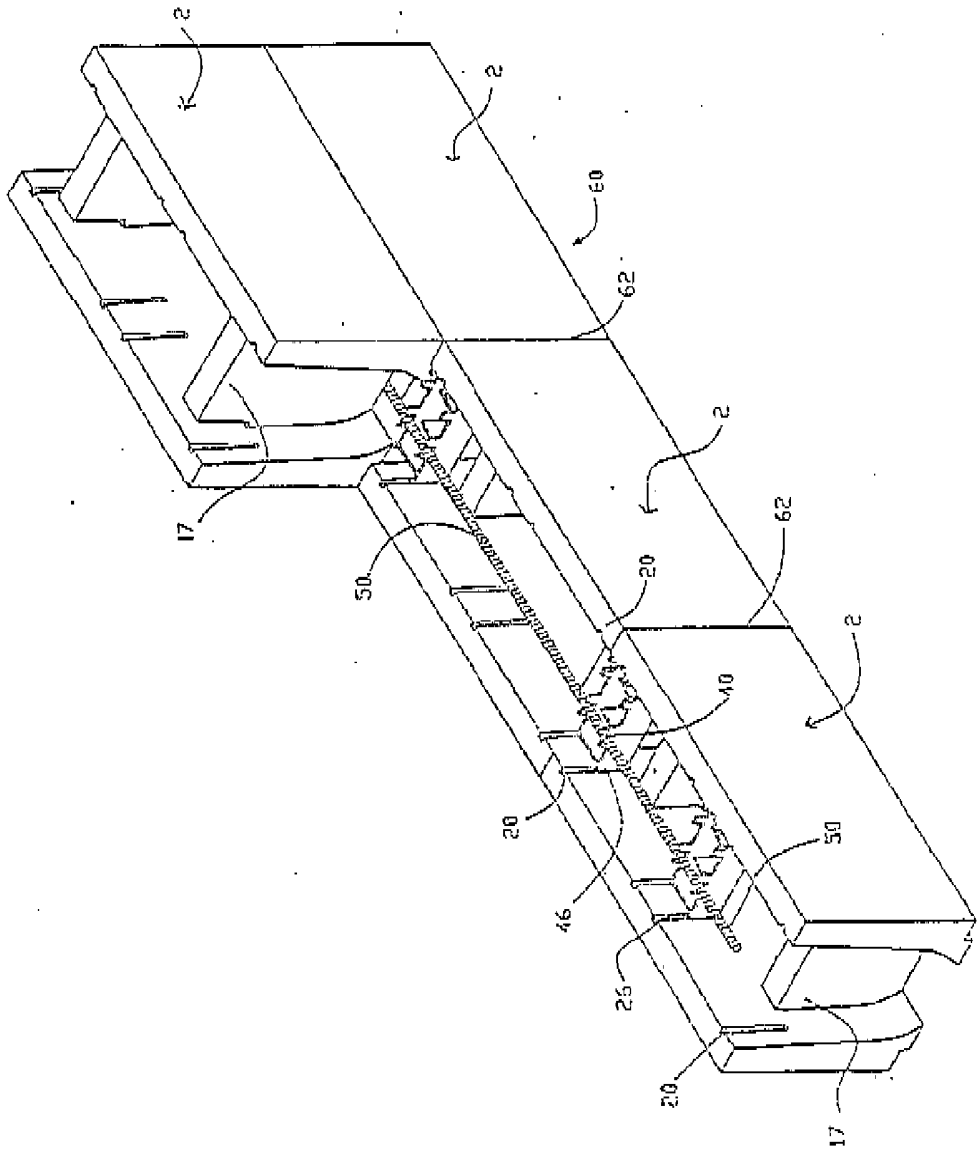


FIG.5

2011253576 22 Nov 2011

Fig.6



COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

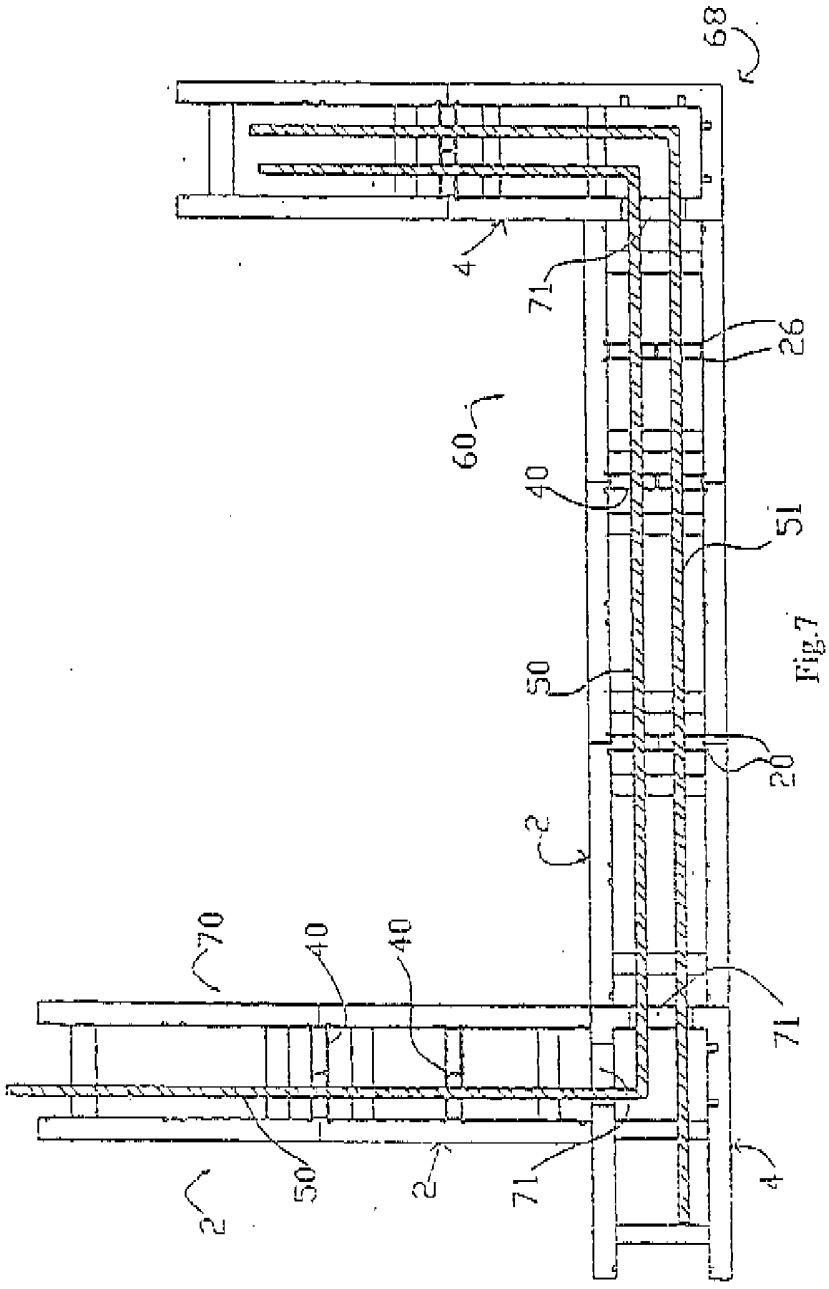


Fig.7

2011253576 22 Nov 2011

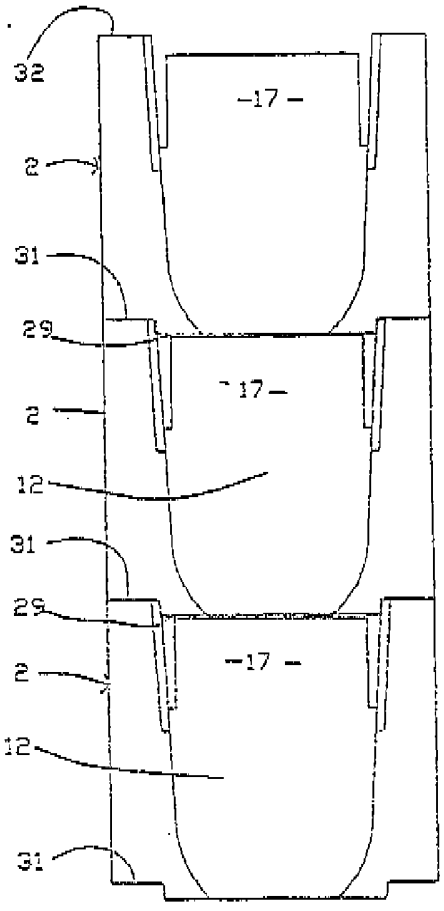


FIG.8

2011253576 22 Nov 2011

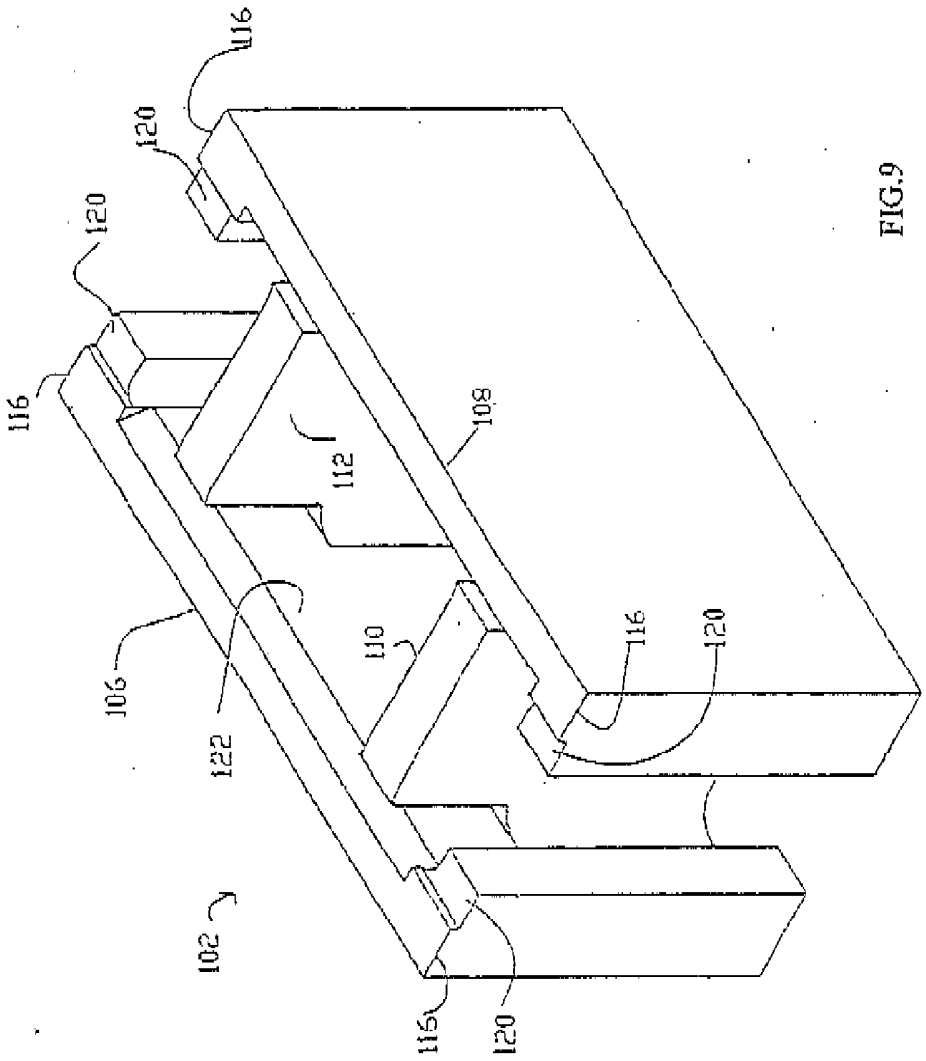


FIG.9

2011253576 22 Nov 2011

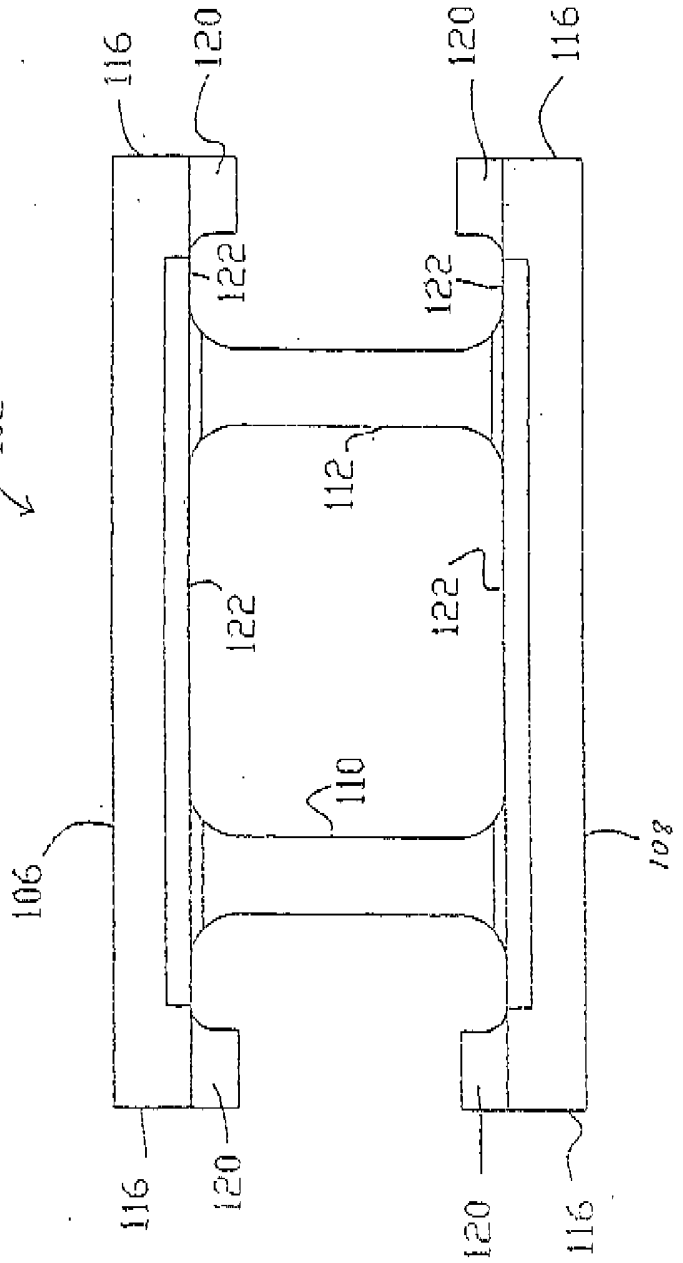


FIG.10

2011253576 22 Nov 2011

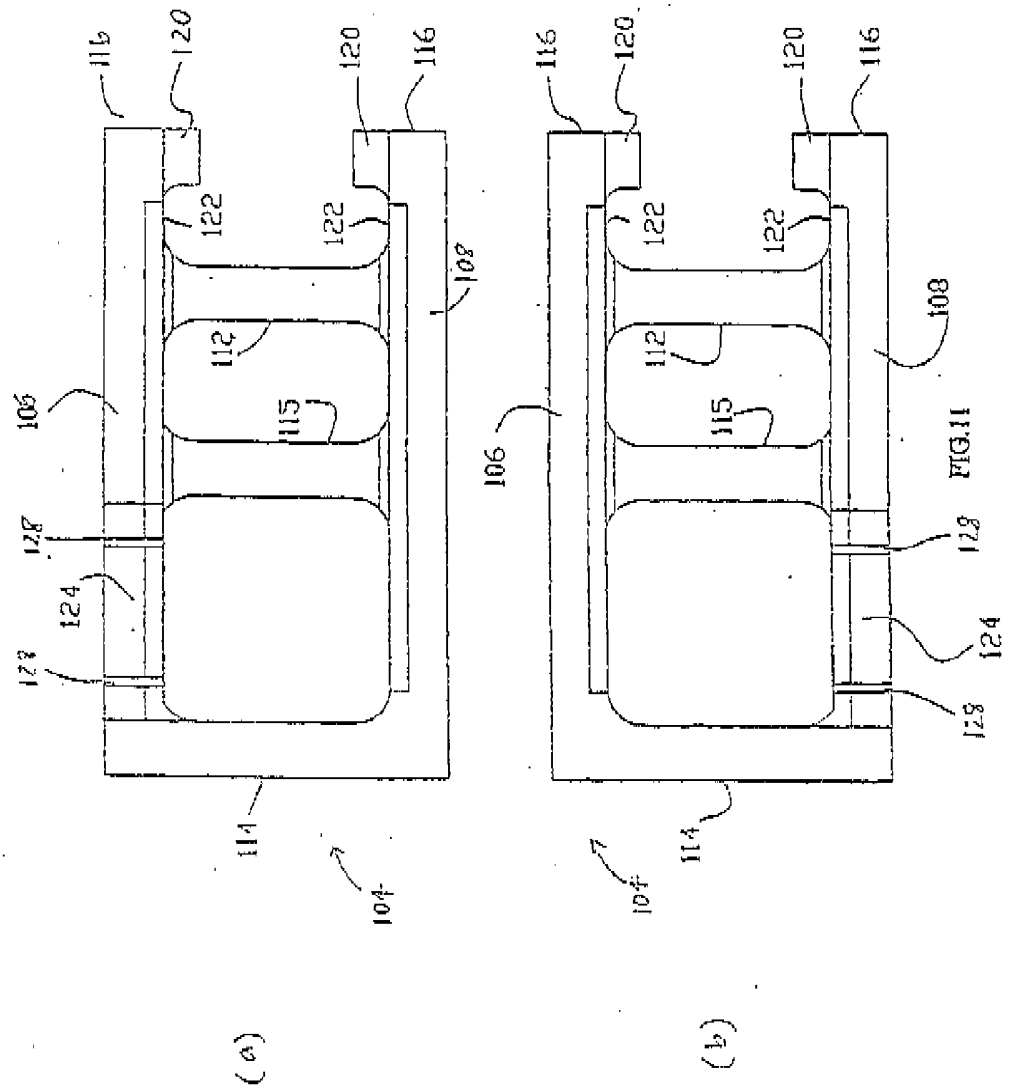


FIG.11

2011253576 22 Nov 2011

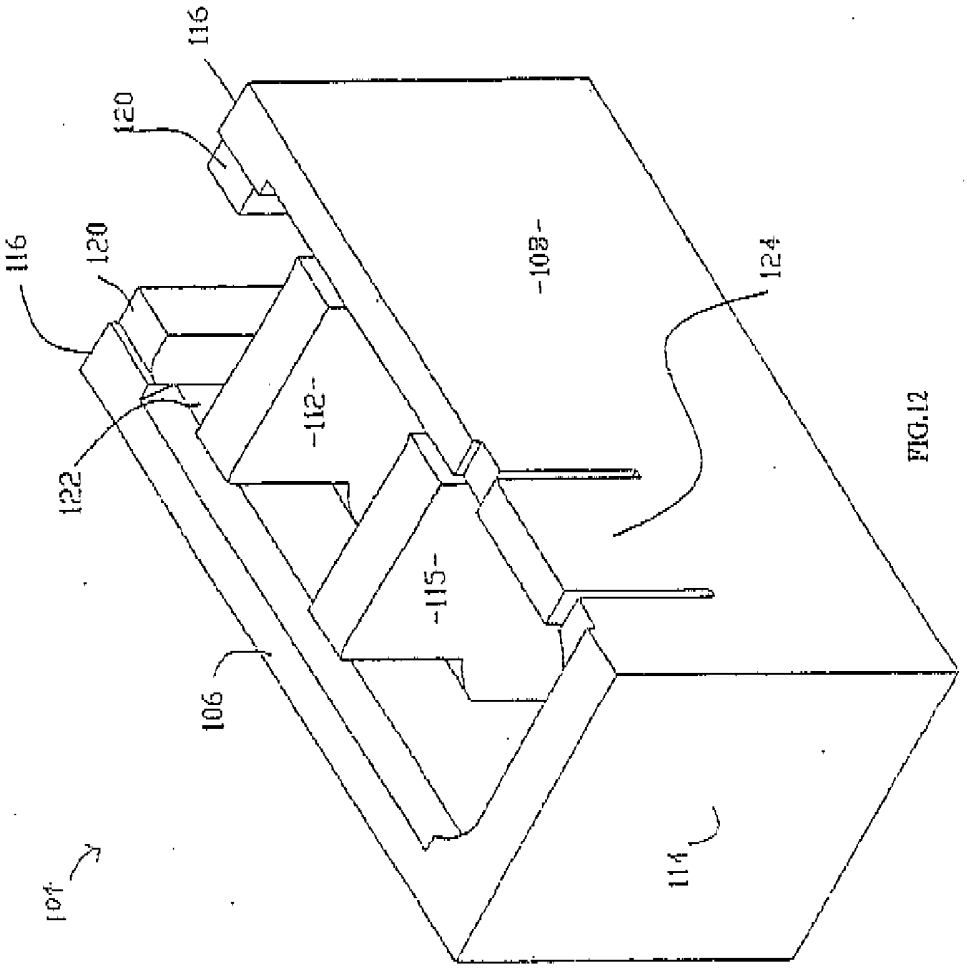


FIG.12

2011253576 22 Nov 2011

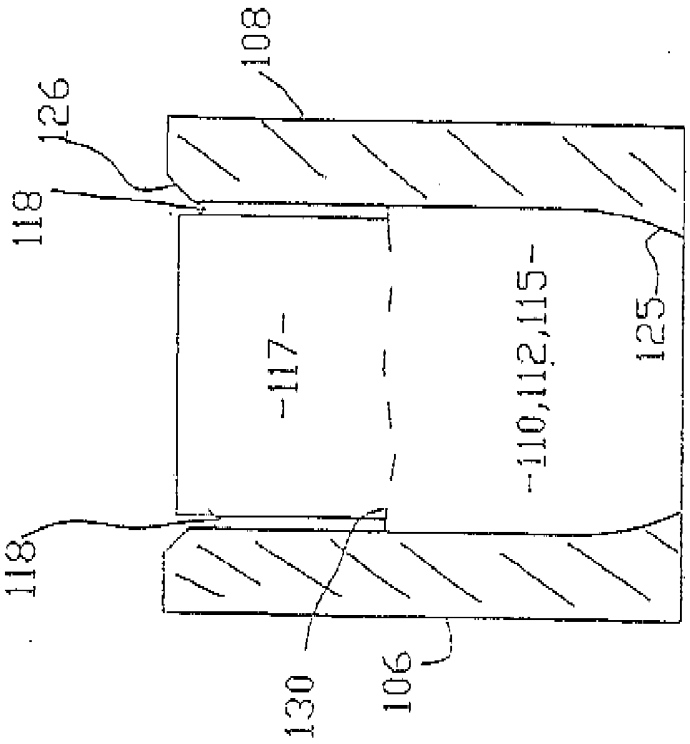


FIG.13

2011253576 22 Nov 2011

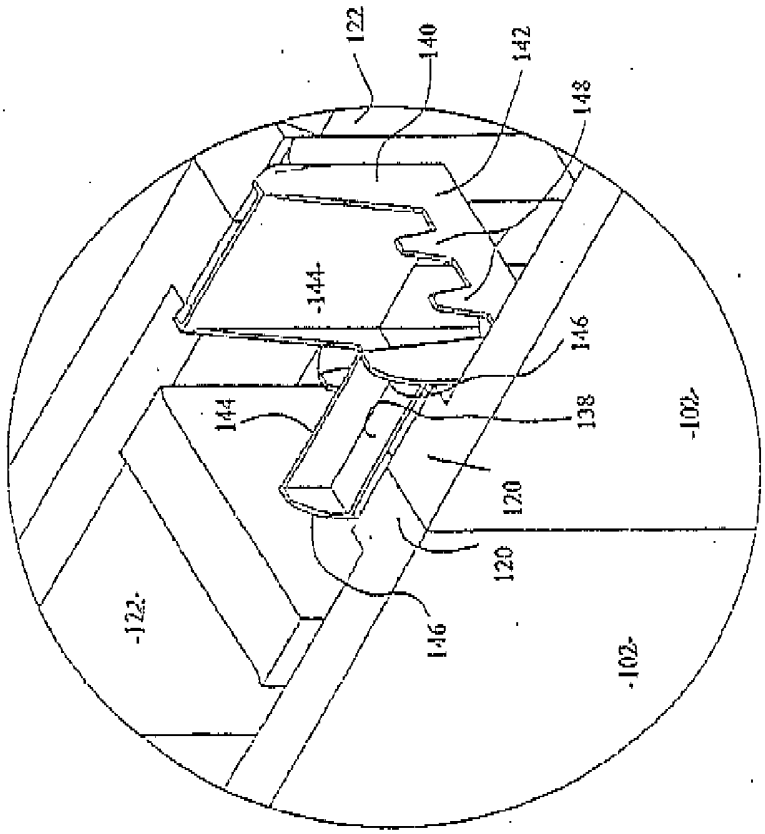


FIG.14

2011253576 22 Nov 2011

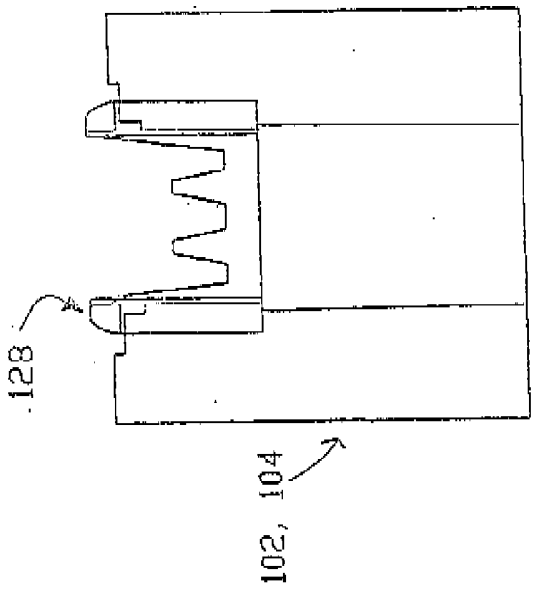


FIG.15(b)

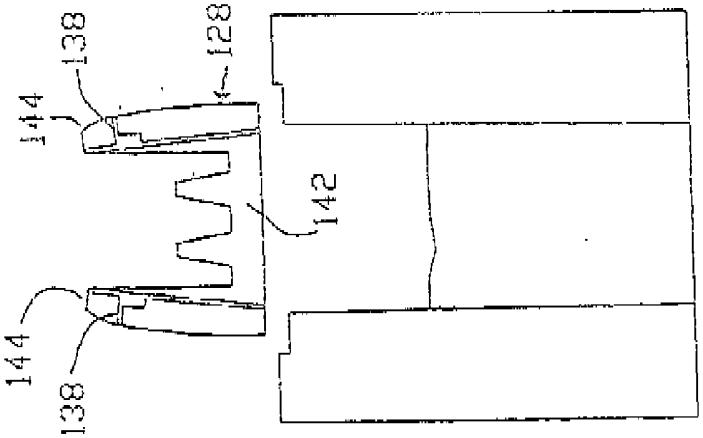


FIG.15(a)

2011253576 22 Nov 2011

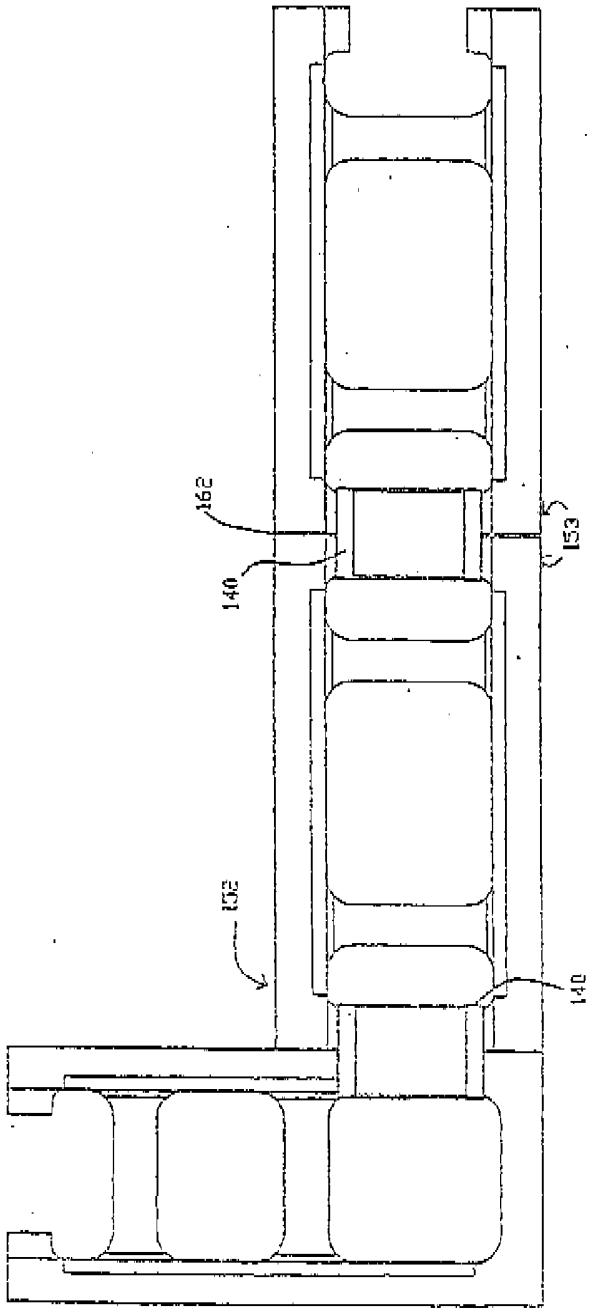


FIG.16

2011253576 22 Nov 2011

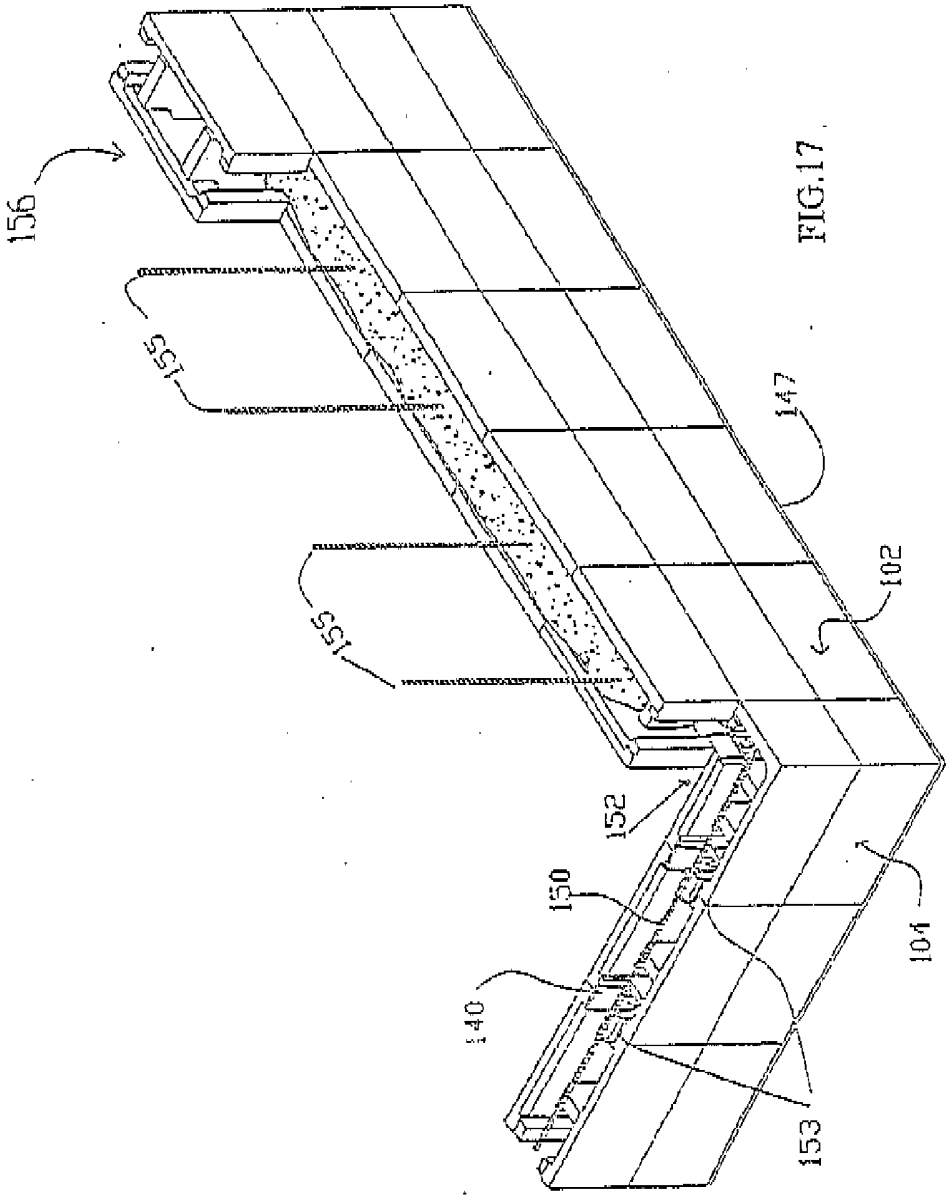


FIG.17

2011253576 22 Nov 2011

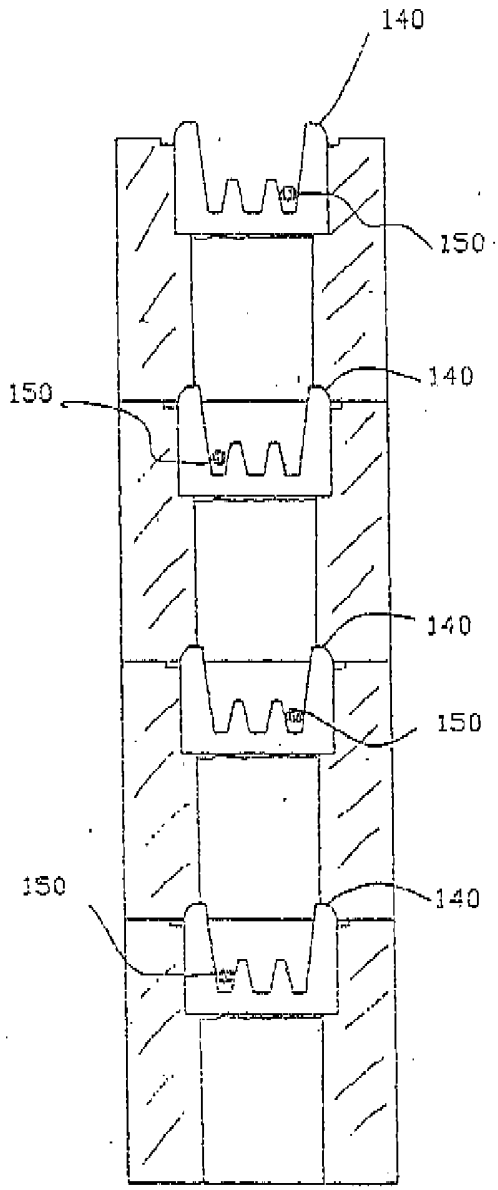


FIG.18

2011253576 22 Nov 2011

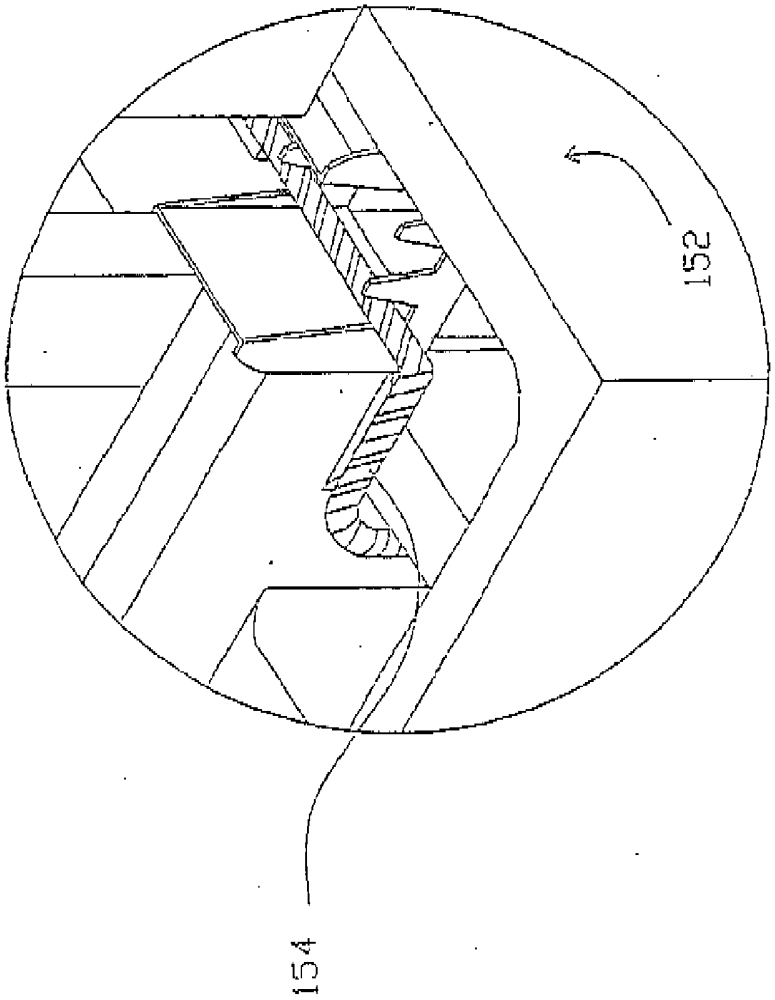


FIG.19

2011253576 22 Nov 2011

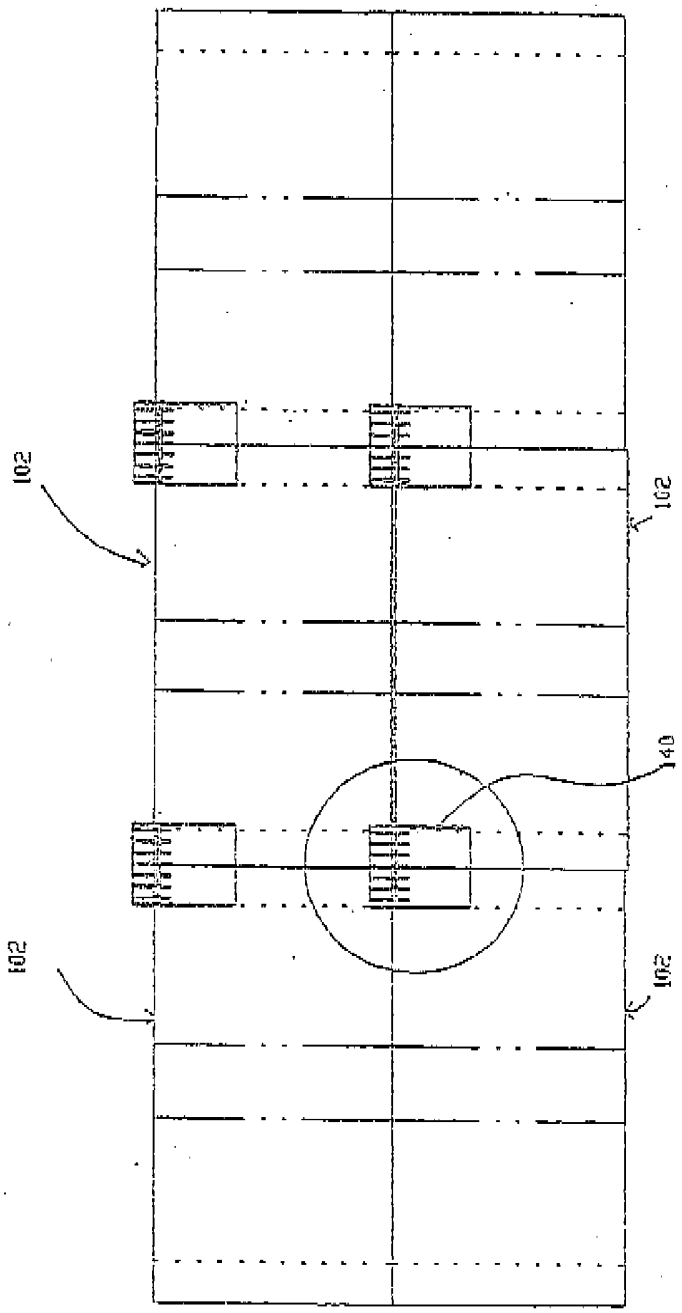


FIG 20.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

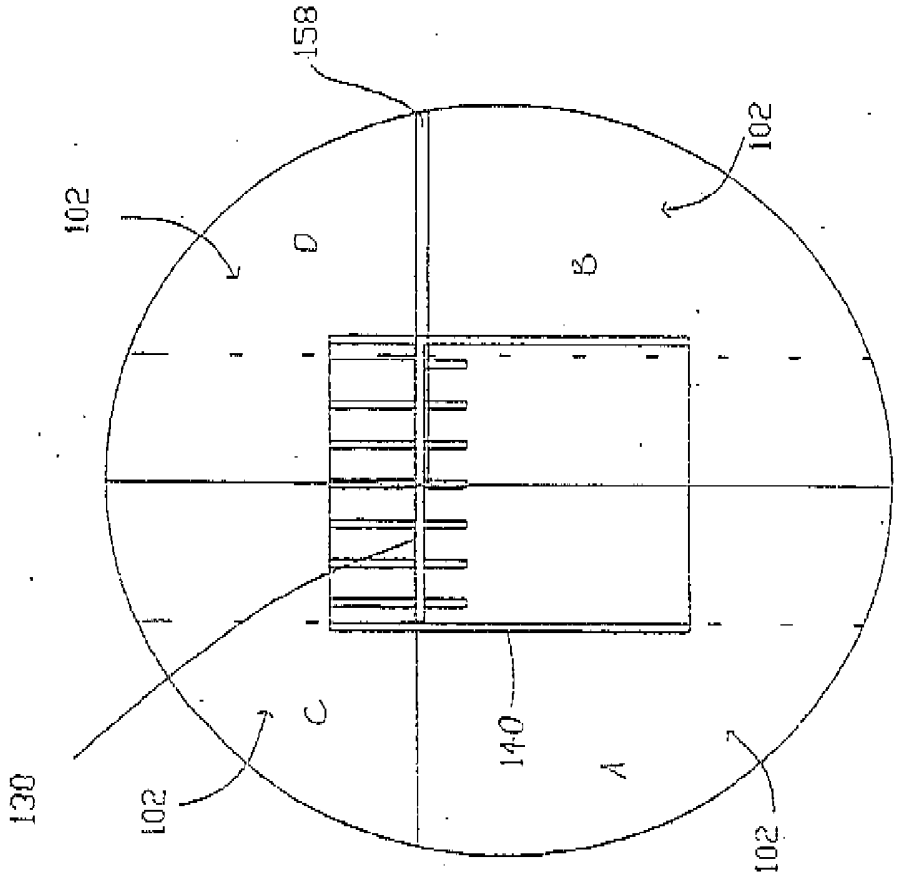


FIG 21

2011253576 22 Nov 2011

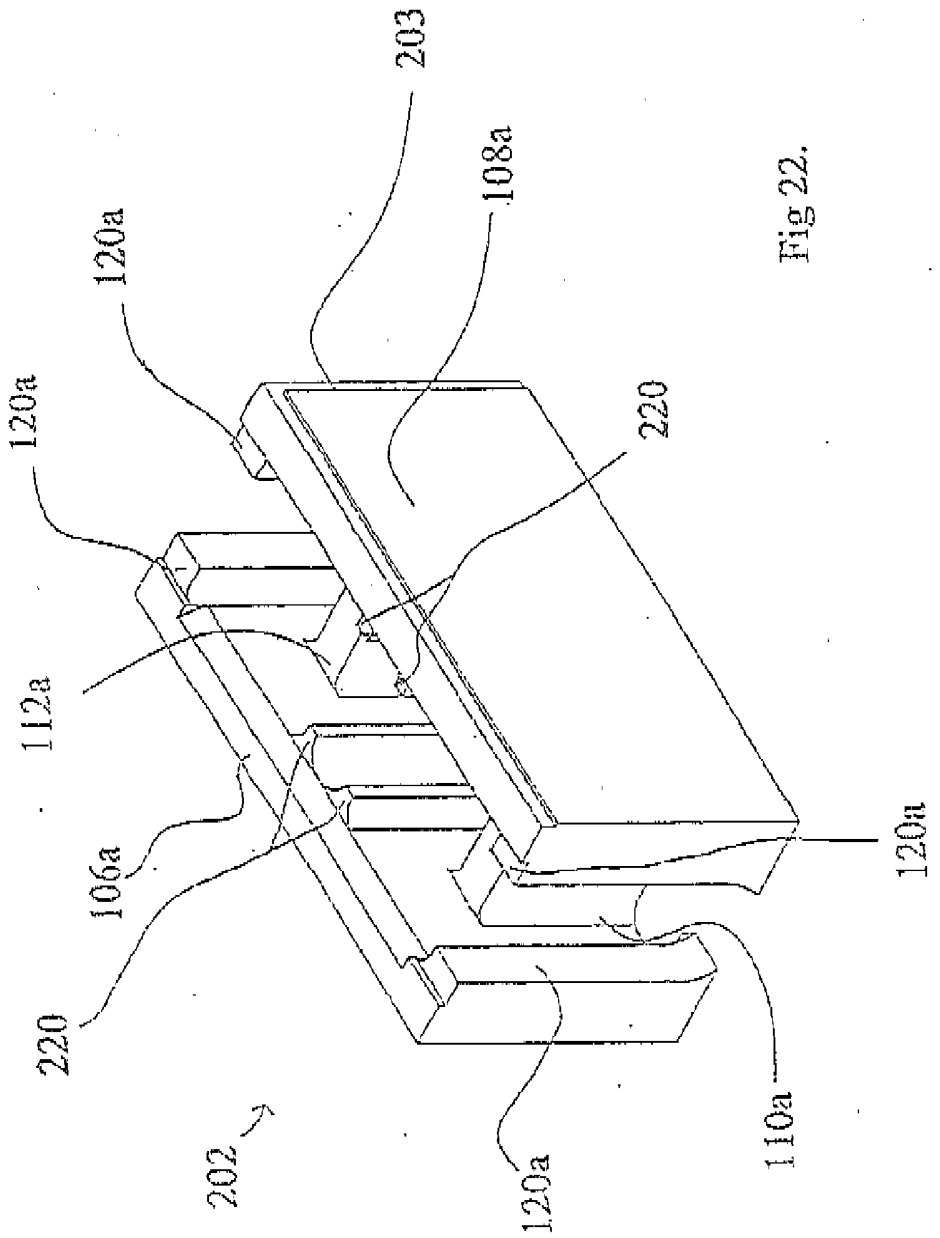


Fig 22.

2011253576 22 Nov 2011

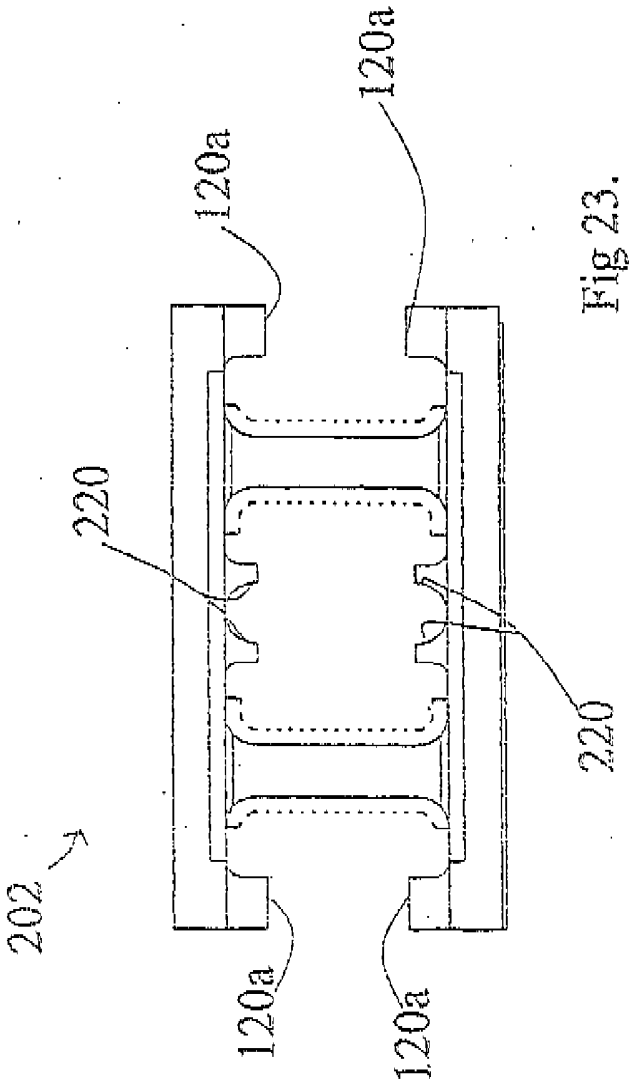


Fig 23.

2011253576 22 Nov 2011

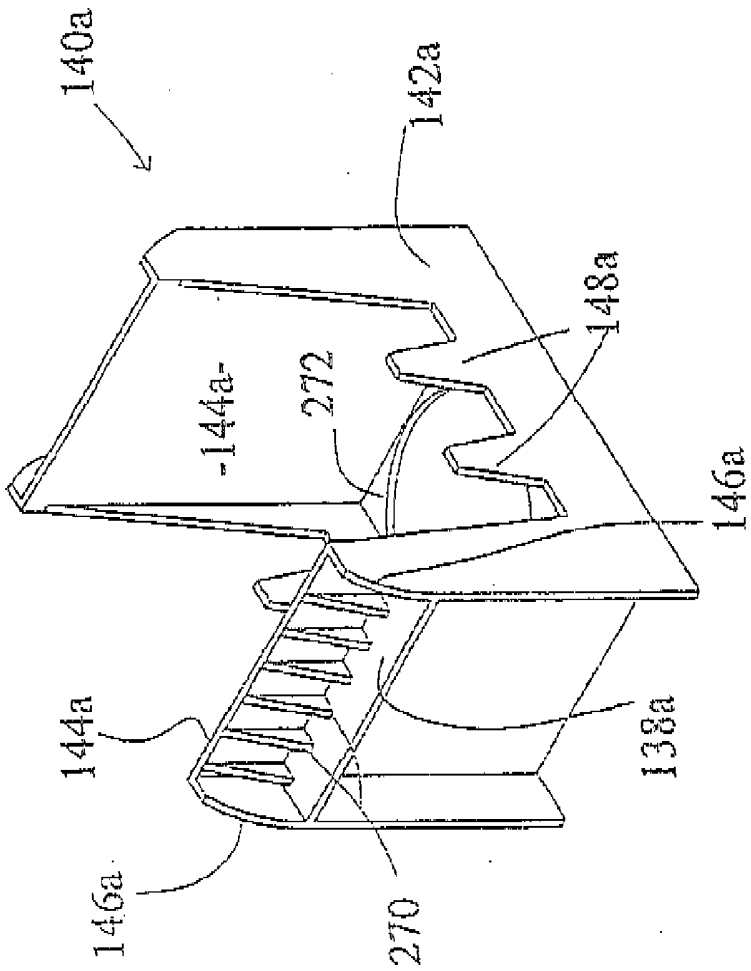


Fig 24

2011253576 22 Nov 2011

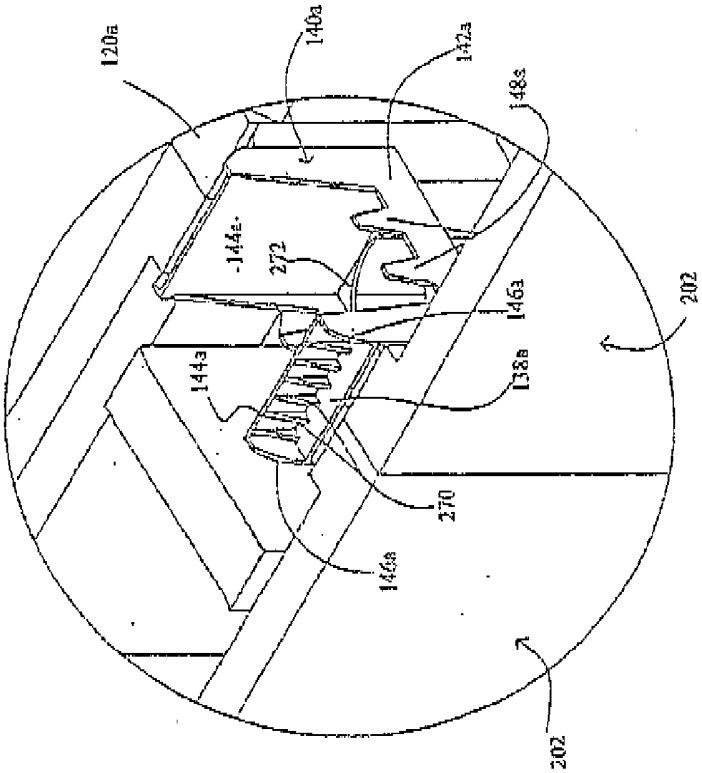


Fig 25.

2011253576 22 Nov 2011

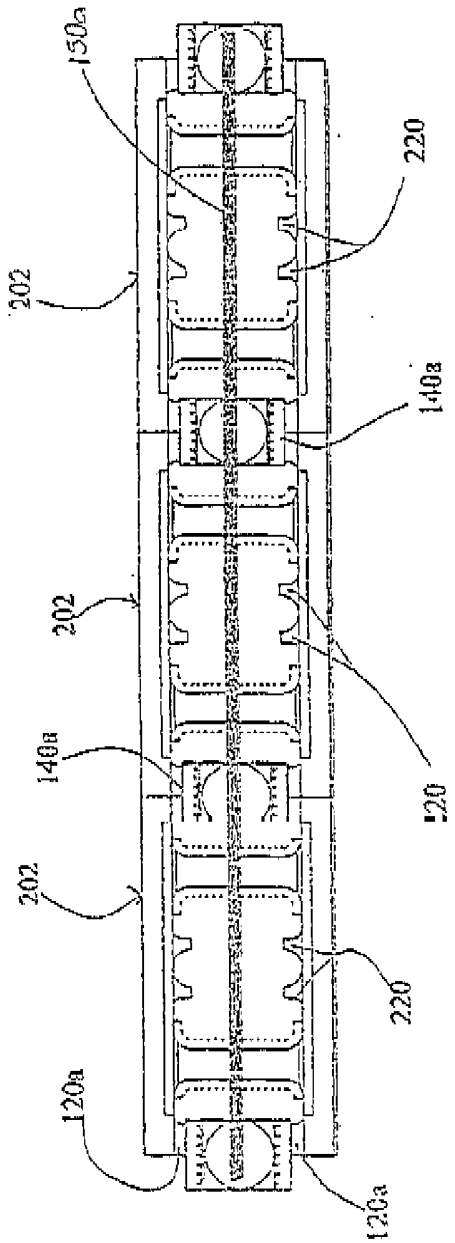


Fig 26.

2011253576 22 Nov 2011

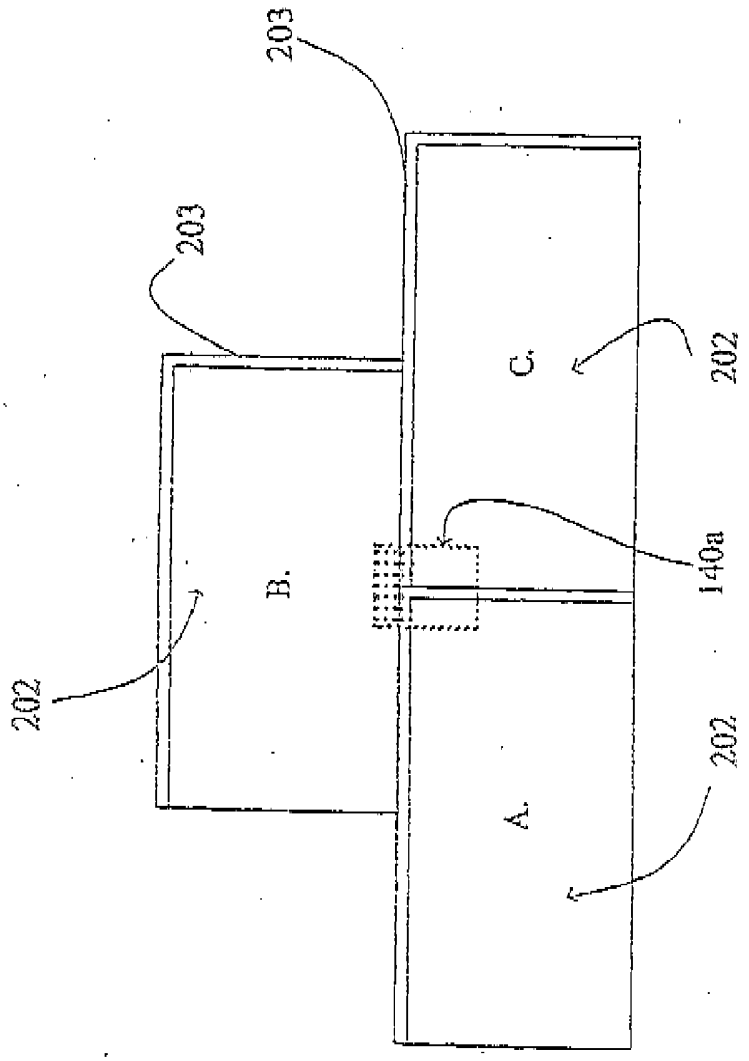


Fig 27.

2011253576 22 Nov 2011

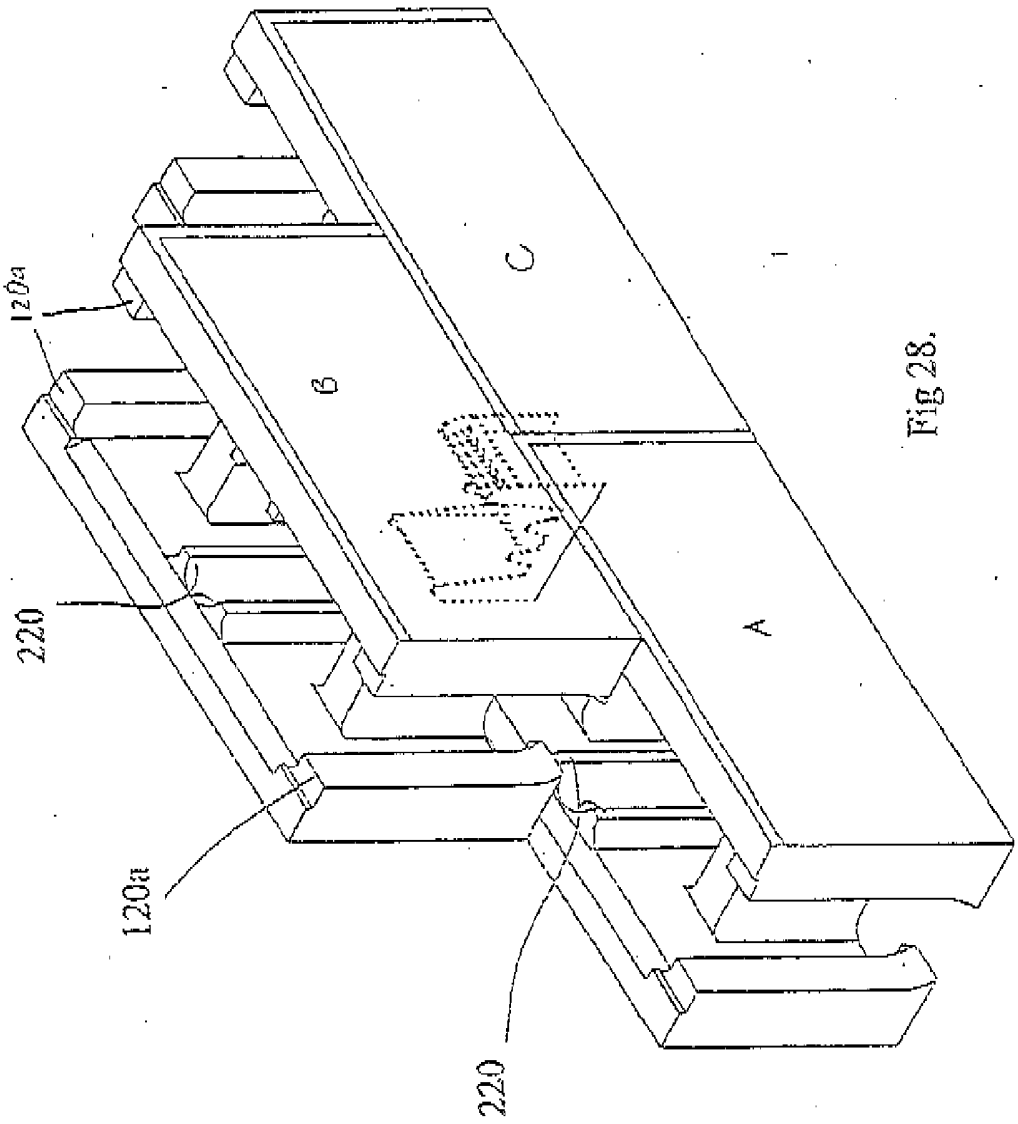


Fig 28.

2011253576 22 Nov 2011

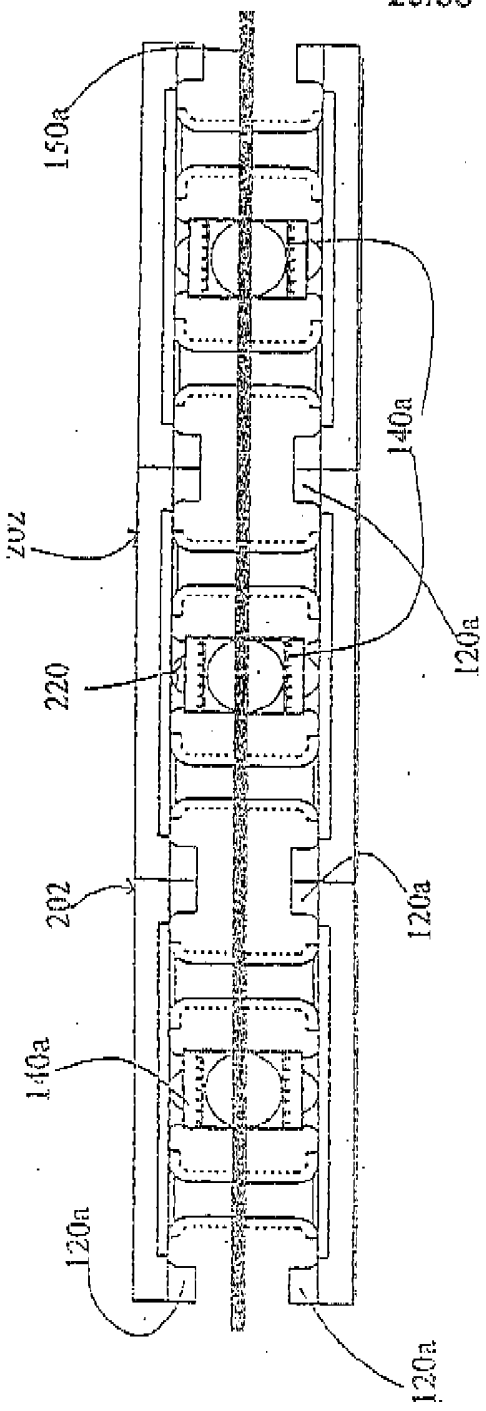


Fig 29.

COMS ID No: ARCS-346158 Received by IP Australia: Time (H:m) 17:07 Date (Y-M-d) 2011-11-22

2011253576 22 Nov 2011

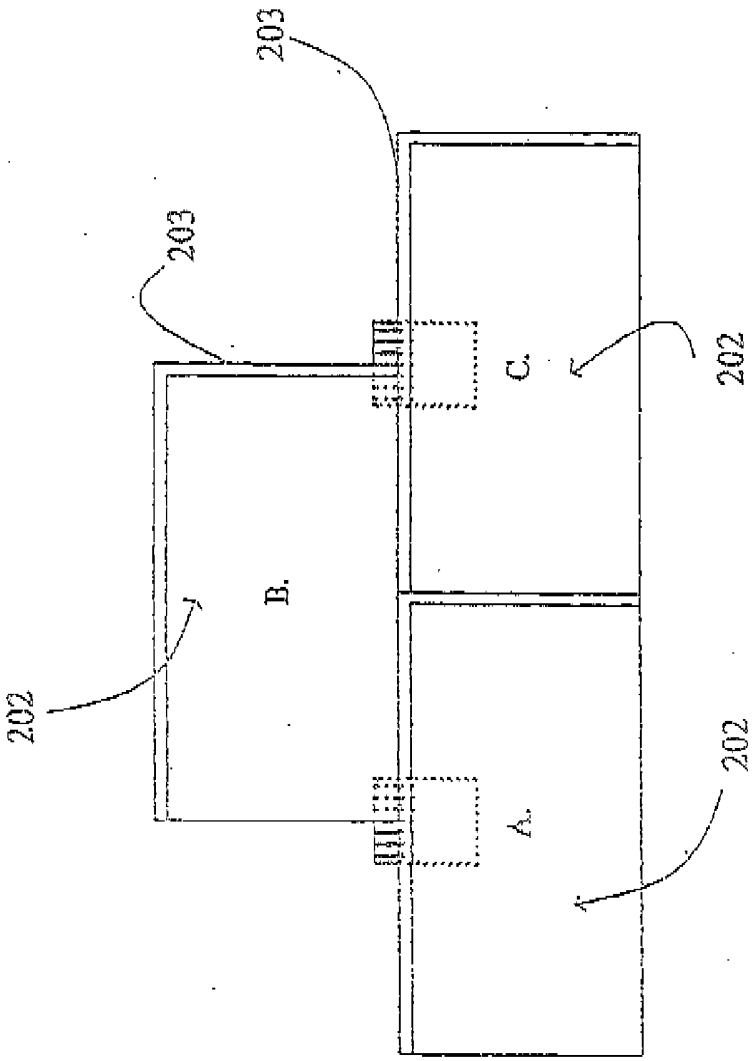


Fig 30.

2011253576 22 Nov 2011

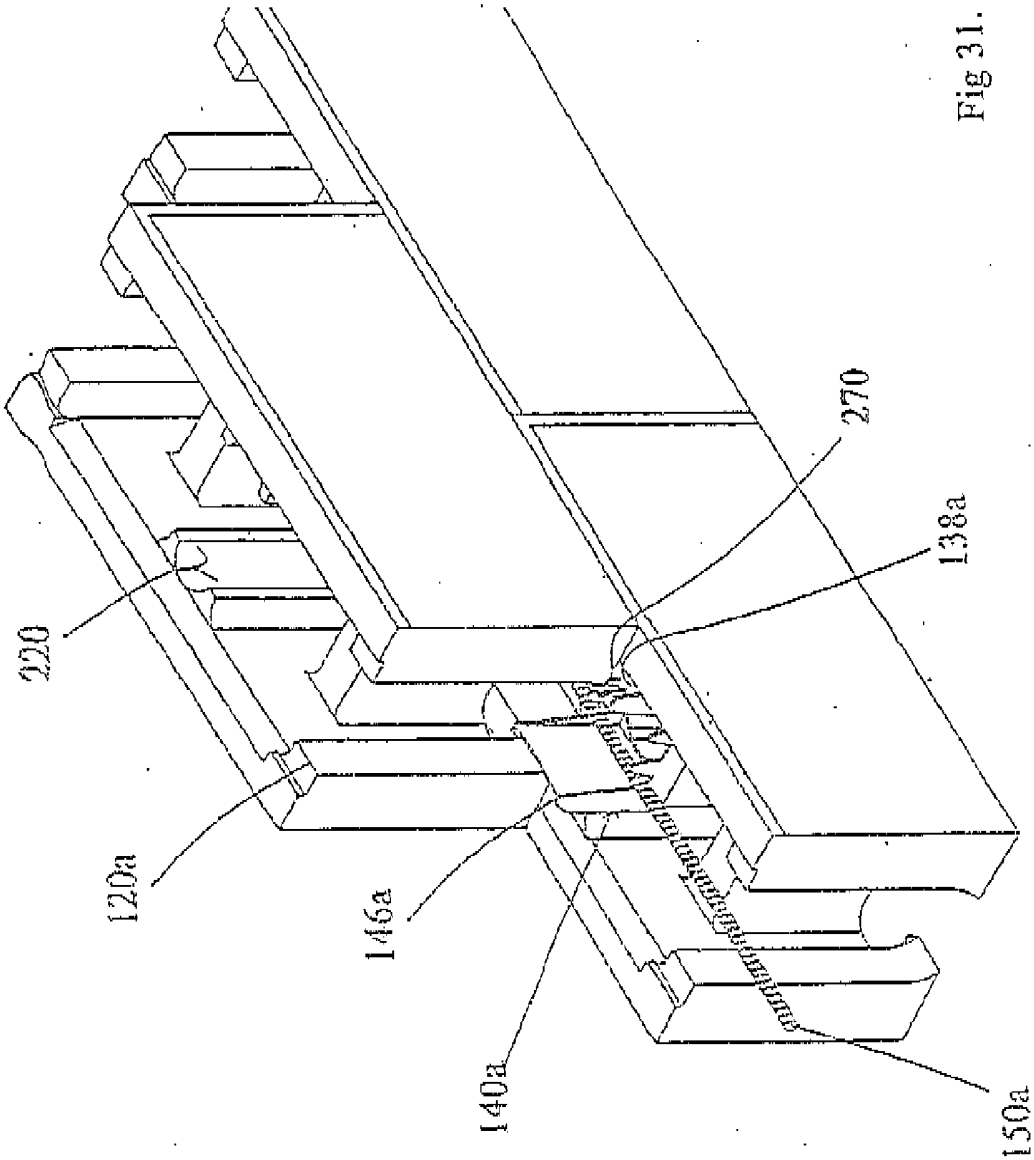


Fig 31.

2011253576 22 Nov 2011

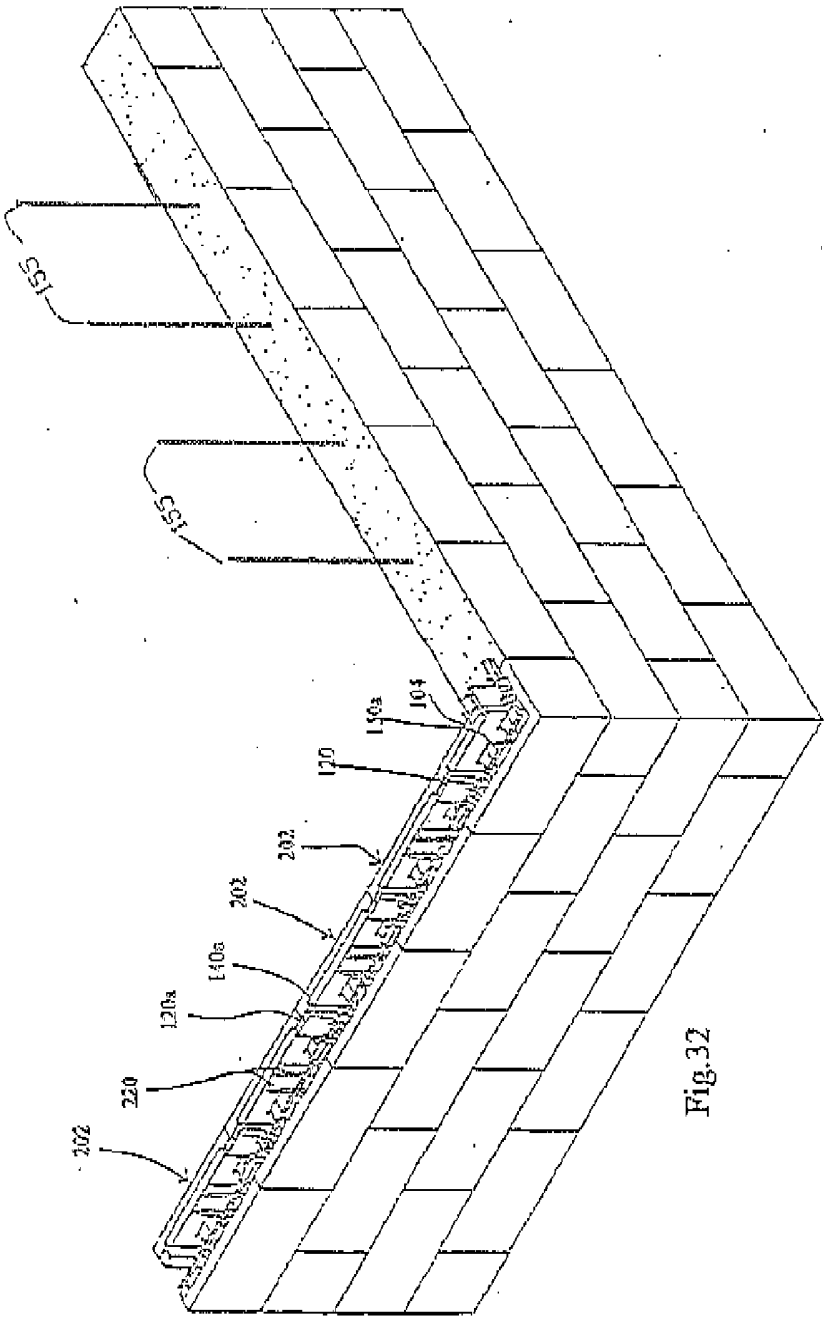


Fig.32

2011253576 22 Nov 2011

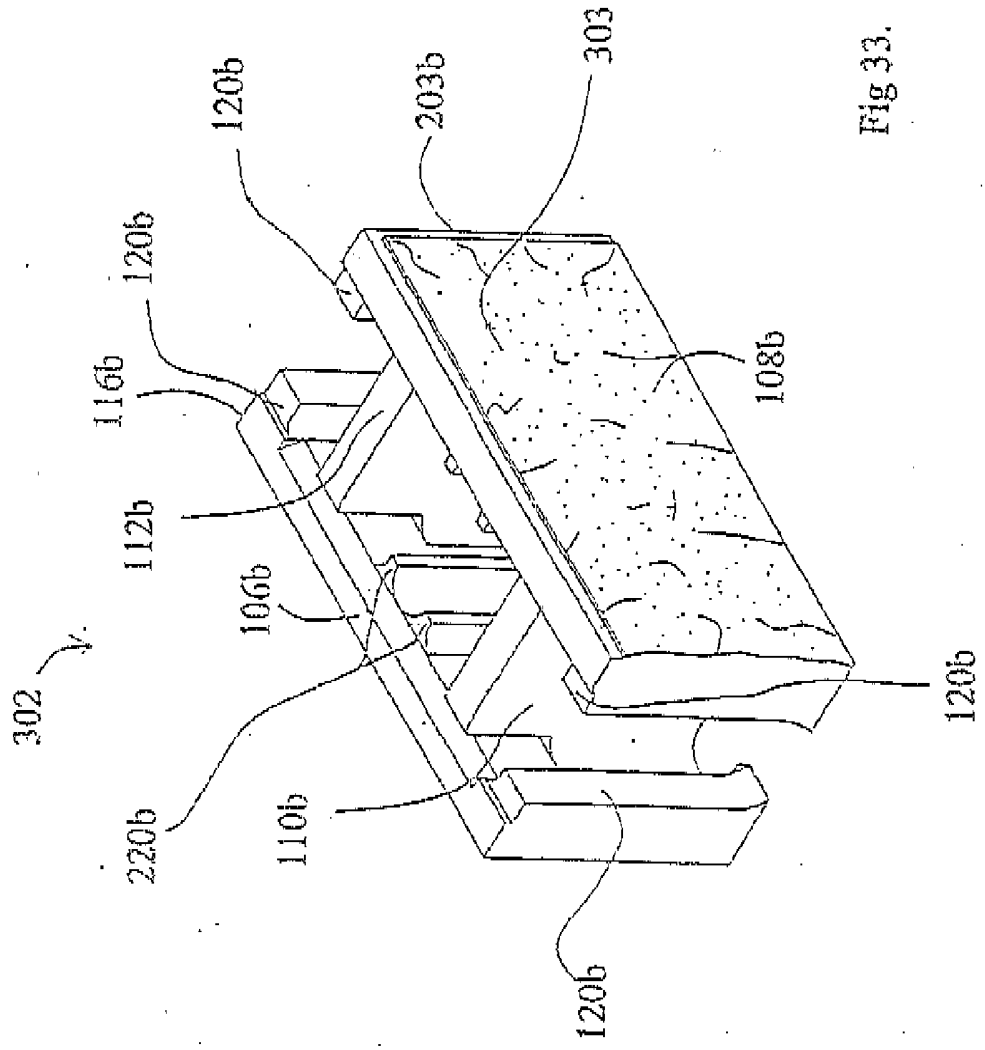


Fig 33.