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(54) A toy construction set formed from plural building blocks.

(57) A construction toy formed from a plurality of building blocks. Some facets of a first major block type (10) are embodied as including a plurality of radially extending vanes (16), others are complementally formed recesses (6). Preferably these recesses (6) and vanes (16) are disposed on top (2) and bottom walls (12) of the building block (10). A periphery (1) is provided with further structure for interconnection with other facets on another compatible block (30,60,80,140,160). Some peripheries (1) are provided with projections (40), others with channels (20). The projections (40) can be received not only in the channels (20), but also within recesses (6) on the bottom walls (12). The channels (20) not only can receive projections (40), but also can receive the vanes (16) on the top wall (2) of the block.

A second major block is configured as a humanoid figurine (210).

A third form of building block (310) is formed as a wafer-shaped rectangle having posts (340) on a top surface (311) and parallel-walled channels (350) on a bottom surface (312).

A fourth major building block is a round wafer-shaped block (330) with beveled gear teeth (334) about a side wall (333) of the block.

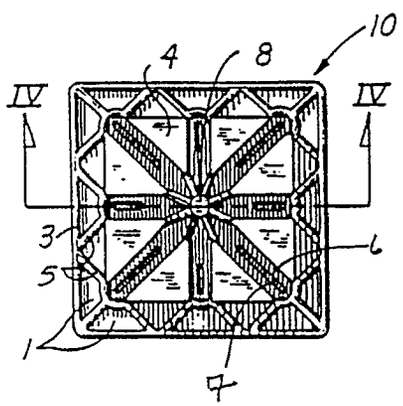

FIG. 1

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A TOY CONSTRUCTION SET FORMED FROM PLURAL BUILDING BLOCKS

FIELD OF THE INVENTION

The following invention relates generally to an instrumentality for creating objects of amusement formed from a plurality of blocks for children. The blocks can be interconnected so that they stimulate the child's imagination and creativity to form structures. The blocks may include participation by a fanciful robotic figurine construction toy. The blocks may also include interfacing gears rotating in a variety of distinct planes.

BACKGROUND OF THE INVENTION

The prior art is relatively rich in attempts at providing construction blocks for children which challenge the child's imagination yet are not so complex as to frustrate the child in his creative endeavors. Not surprisingly, many known patents can be grouped into the above noted objection categories as being either too simple or too complex.

The following patents reflect the state of the art of which applicant is aware and are included herewith to discharge applicant's acknowledged duty to disclose relevant prior art. It is stipulated, however, that none of these references teach singly nor render obvious when considered in any conceivable combination the nexus of the instant invention as disclosed in greater detail hereinafter and as particularly claimed.

INVENTOR	PATENT NO.	ISSUE DATE
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Lewis	1,405,851	February 7, 1922
Hultman	1,554,095	September 15, 1925
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Svagerko	4,792,319	December 20, 1988
Heiremans	EP-89/00069	January 12, 1989

The prior art listed above shows the state of the art of which applicant is aware. Each of these references is distinguishable from the applicant's invention as claimed.

SUMMARY OF THE INVENTION

In general, one majority type of the blocks forming the instant invention assume a substantially wafer like configuration having a top surface and a bottom surface. The top surface is effectively the compliment of the bottom surface and visa versa. That is, each surface is formed with a series of projections and recesses. The recesses on one surface define the projections on the other surface. In this manner, all similar blocks thus formed are capable of being stacked and locked one on top of the other.

In practice, the projections and associated recesses defining the top and bottom surfaces of these blocks are oriented such that a plurality of radially extending vanes are provided on one surface and the

corresponding complemental recesses on the opposite surface are provided between a plurality of radially extending wedges. Because of this symmetry, each block has a "radiance" when viewing the top and bottom surfaces of the wafer shaped building block. By "radiance" it is meant to connote a center having radially diverging lines.

Besides the top and bottom surfaces being inverse images of one another, each wafer-shaped building block includes a peripheral side wall circumscribing the block provided with a further means for interconnecting adjacent blocks. The interconnection means generally embraces one of two forms, either a projection or a channel. Blocks having a peripheral wall that includes the circumscribing channel can therefore be connected with those blocks having circumscribing projections by insertion of the projection into the channel. This channel can also connect with the vanes on the block's top surface because the vanes and the projections have the same thickness. Building blocks having a peripheral projection can also connect between the wedges formed on the surface of the block which defines the recesses. Alternatively stated, the blocks can be interconnected by stacking the surfaces, by placing an appropriate edge of the block on a surface, or by connecting edges.

Because of the radiating pattern of the vanes and the associated wedges, orientation of the blocks for interconnection is relatively neutral. Thus, two surfaces can be interconnected in such a manner that incremental rotation of under and overlying blocks is possible so long as the rotational increment equals 360/2N degrees. N equals the number of sides on a block. Thus, where N equals 4, rotation of a block 45 degrees will allow it to be connected to its counterpart without difficulty. Similarly, because the peripheral sidewall is dimensioned such that its channel (or projection) on the peripheral sidewall corresponds to the thickness of the vane (or recess), it too can be rotated when its edge is connected to a top or bottom block surface.

In addition, because the radially directed vanes and complementally formed recesses occur along an axis of symmetry on the top and bottom surfaces, the blocks can be interconnected only on sectors of the block. This means that over and underlying blocks can be terraced, forming imbrications or further tying blocks together via overlap. This allows adjacent blocks to be further interconnected so that one block can interconnect with plural adjacent blocks. Where N equals 4, the sectors are quadrants.

Moreover, the phenomena of overlap can also be utilized to advantage with respect to the side wall channels and projections. These can overlap other sidewalls, vanes and recesses as will be developed.

In general a second major type of construction toy of the instant invention is configured as a substantially humanoid figurine. This means that a head area provided for on the wafer also defines a first fastening means. A pair of arms and pair of legs also extend outwardly from the human torso defined by the central vane and wedge area.

The head itself is configured with a curved profile having general facial features and defining a first fastening means. The legs defined by two pairs of planar material are configured to provide the second and third fastening means. The arms extend outwardly from a central torso portion and collectively define the fourth, fifth and sixth fastening means. Each of these fastening means are strategically designed to complementally engage not only one another in certain mating fashions but also the recesses and vanes defining the first and second attachment areas on the main torso portion.

Stated succinctly, the humanoid figurine uses the combined wedge, recess and vane structure of the first described block to provide all of the advantages associated therewith. Accordingly, the added associated benefits and advantages inherent in the humanoid block devolve from the foregoing features when taken in conjunction with the structure defining the head, the legs and the arms. Specifically, the head includes a curved contour circumscribed within a peripheral ridge defining a first fastening means. The ridge is dimensioned to be received between adjacent wedges such as on the torso or where a similarly dimensioned groove or gap appears.

Next, the legs are formed from two spaced pairs of substantially planar stock, each pair interrupted by a groove, the groove having a dimension corresponding to the thickness of the peripheral ridge of the head, for example, or the vanes of the major torso portion of the body. Thus, this leg groove can interconnect other similar toys capable of locking in this groove.

Next, the figurine has arms which extend outwardly from the body. The arms have the nominal thickness of the peripheral ridge defining the head. This means that the arms can be used as connectors in the same way that the vanes are utilized. In addition, a front portion of each of the arms includes a pair of forwardly-extending, spaced, locking ribs dimensioned to serve as the aforementioned groove or the recess between adjacent wedges for similar fastening purposes. A back face of the arm has a single outwardly extending locking tab which operates similar to the vanes and the thickness of the head as further fastening means.

A third major block type is provided with attachment means on a top surface including a plurality of

posts oriented in linear rows which radiate out from a center of the top surface. The posts have a toroidal flair near an outer end which extends around each post in a horizontal plane parallel to the top surface.

An attachment means on the bottom surface includes a plurality of channels which extend radially outwardly from a center of the bottom surface. Each channel is formed from a pair of walls extending outward from the bottom surface orthogonal to the bottom surface. On a side of each wall, facing its complemental channel wall pair, a ledge is formed which extends inwardly and in a plane horizontal to the bottom surface.

When the top surface of one block is brought into contact with the bottom surface of another block, the posts of the top surface fit within the channels of the bottom surface and the toroidal flair of each post snaps snugly above the ledge formed in the walls of the channels of the bottom surface. Two blocks may thus be connected top-to-bottom in a variety of different ways by holding one block in position and rotating the other block or displacing the other block linearly. The walls of the channels on the bottom surface of the blocks are substantially parallel to each other. The posts are all of similar diameter.

A fourth major type of block is described which assumes a substantially wafer-like configuration having a top surface and a bottom surface. The top surface of these blocks is similar to the top surface of the third type of block. The bottom surface, however, has a hub which is a hollow cylindrical construct extending outwardly perpendicular to the bottom surface. This block has one curved side edge making the secondary blocks substantially circular in cross-section. Along the side edge of the blocks are formed a plurality of beveled gear teeth. These gear teeth allow pairs of these blocks to interface in a rotational manner, with one gear being able to cause the other gear to rotate. The gear teeth of the blocks are also beveled to allow the pairs of blocks to be oriented with their top surfaces in planes not parallel with each other, thus forming a beveled gear pair.

The third type of block has a plurality of prominences and orifices along side surfaces. Each side of the primary blocks has either a prominence or an orifice with the prominences being of a design similar to that of the hubs of the fourth type of block. The orifices of these blocks are cylindrical cavities which extend inwardly perpendicular to the side surfaces. Extending longitudinally along a side surface of the orifices are a plurality of undulations. The prominences have a plurality of ribs extending longitudinally along side walls of the prominences. The prominences are of complemental shape to the orifices such that a pair of blocks may be connected together along side surfaces with a prominence fitting within an orifice securely with the ribs preventing rotation. A hub of the fourth type of block may fit within an orifice of a third type block restricting the block pair from relative translation but allowing the fourth type block to rotate within the orifice of the third type block.

The third type blocks are of two different sizes. Some are full size, characterized by being equal in length on a long side to a pitch circle of the fourth type block. This size allows two full size third type blocks, attached adjacently on side edges, to receive two fourth type blocks which are then of sufficient separation to allow the gear teeth of the two separate fourth type blocks to interface. Other third type blocks are essentially half size, characterized by being equal in length to the full size blocks in two directions but are half the length in a third direction. This size allows three half-size blocks, attached adjacently on side edges, to receive two fourth type blocks within the orifices of the two outside half-size blocks. This orients the two fourth type blocks with sufficient separation to allow the gear teeth of the two fourth type blocks to interface, simulating the action of a planar gear pair.

Each third type block has orifices on three side surfaces and a prominence on one side surface. The orifices are oriented such that two orifices on two adjacent sides are an equal distance from the corner between the two sides. This distance is equal to a radius of the pitch circle of the fourth type blocks. The gear teeth of these fourth type blocks are beveled at a 45° angle. When two such fourth type blocks are oriented orthogonally with their associated hubs within two adjacent orifices of the third type block, the gear teeth of the two fourth type blocks interface. This orientation simulates the action of a beveled gear pair. Multiple blocks can form structures including moving mechanisms with these four major type blocks along with other blocks to be described.

Succinctly stated, the instant invention spans the spectrum of complexity from a most simple toy to a most demanding, complex and creative toy to accommodate the interest pattern and skill level of the widest cross section of children and adults. The blocks themselves are capable of interconnection on all surfaces and also are capable of overlapping with adjacent blocks in a number of patterns. The blocks themselves are also both optically ornate and of complex contour to provide both a visual and tactile stimulus.

OBJECTS OF THE INVENTION

A primary object of the present invention is to provide a novel and useful construction toy set.

A further object is to provide a device as characterized above which includes a top wall, a bottom wall and a periphery between the top and bottom wall, the top wall defining a first attachment surface, the bottom wall defining a second attachment surface, the first and second attachment surface defining complemental, interconnecting contours, of at least one radiating vane of constant width on one wall frictionally fit within a complementally formed space on another wall and a periphery defines a third attachment surface.

A further object, viewed from a different vantage point is to provide a wafer-shaped toy wherein a top wall includes a plurality of uniform width radially extending vanes, a bottom wall including a plurality of uniform width radially extending spaces dimensioned to frictionally receive vanes therewithin, and a peripheral edge extending between the top and bottom walls provided with means for linking the edge with another wafer.

A further object is to provide a device as characterized above which includes a plurality of facets defining an exterior of a first element means of constant width on the facet for connecting the first element to a second element, the second element having multiple facets defining an exterior and provided with uniting means to frictionally receive the connecting means whereby the uniting and connecting means allow the first and second element to be linked.

A further object is to provide a device as characterized above which includes a figurine construction toy, including a front wall defining a first attachment surface, a rear wall having a second attachment surface, the first and second attachment surfaces defining complemental connecting means, a top simulative head area extending up from the front and rear walls having a thickness defining a first fastening means, two pairs of legs extending down from the front and rear walls having means defining a second and third fastening means, and one pair of arms extending from the front and rear walls having means defining fourth, fifth and sixth fastening means.

A further object is to provide a device as characterized above which includes a torso, arms extending from the torso, legs extending from the torso, a head extending from the torso and plural attachment means on the torso at front and rear portions thereof wherein the figurine attaches to another construction toy.

A further object is to provide a device as characterized above which includes a wafer having a front wall, a rear wall and a periphery defining a torso, complemental radially extending attachment means of uniform width on the front and rear walls, the periphery including extensions emanating therefrom provided with plural fastening means for attachment to other construction toys.

A further object is to provide a device as characterized above which includes a building block having a top surface, a bottom surface opposite the top surface and a plurality of side surfaces, the top surface being equipped with a plurality of circular posts of equal diameter and length extending upwardly from the top surface in a plurality of linear rows which extend from a center of the top surface, the bottom surface being equipped with attachment means whereby multiple blocks are interconnectable via the posts and the attachment means.

A further object is to provide a device as characterized above which includes a plurality of primary blocks having a top surface, a bottom surface and side surfaces, the top surface having an attachment means and the bottom surface having attachment means which complements the top surface attachment means allowing the top surface of one of the primary blocks to connect to the bottom surface of another of the primary blocks, and the side surfaces having either a first attachment means for a second attachment which which are complemental to each other allowing one side surface of one primary block with a first attachment means to connect with another side surface of another primary block with a second attachment means, and a plurality of gear blocks having a top surface, a bottom surface and a circular side surface, the top surface having an attachment means and the side surface having an interfacing means allowing one gear block to tangentially contact another gear block such that when one gear block rotates another gear block may also rotate, whereby a combination of the blocks may be created in a variety of interesting and educational configurations.

A further object is to provide a device as characterized above which includes a toy gear set for educating children, including a plurality of gear blocks with a hub on a bottom surface, teeth on a side surface and a driver block attachment means on a top surface, a plurality of driver blocks capable of fastening to each other with a plurality of orifices and prominences on a plurality of side surface thereof, the orifices dimensioned to support the hubs of the gear blocks allowing rotation of the gears without translation, and a plurality of drive blocks having prominence on a side thereof dimensioned to connect to a driver attachment means on the gear top surface of the gear blocks while allowing free rotation thereon, whereby the driver blocks may be combined together with the orifices and the prominences, the gear blocks may be combined with the mounting blocks through connection of the hubs with the orifices in an

orientation where the teeth on the side surfaces of the gear blocks are tangential to each other and the driver blocks are connected to the top surface of the gear blocks, thus allowing an input force applied to the toy gear set to cause rotation of each gear block within the toy gear set.

A further object is to provide a device as characterized above which includes a plurality of construction blocks having multiple facets, one facet on each block having a prominence projecting from the face, the prominence including means to allow deflection of the prominence both centrally inwardly and outwardly, and means for securing the facet bearing the prominence to another facet of another block.

A further object is to provide a device as characterized above which includes a facet on each block including a plurality of posts project from the facet, the post having retention means circumscribing the post for fastening to another facet of another block.

A further object is to provide a device as characterized above which includes a gear block with one facet on one gear block having gear teeth with planar and orthogonal meshing means to mesh with gear teeth on another gear block having similar meshing means.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

Figure 1 is a front plan view of a first major block according to one form of the invention.
Figure 2 is a side view thereof.
Figure 3 is a bottom plan view of that which is shown in figures 1 and 2.
Figure 4 is a sectional view taken along lines IV-IV of figure 1.
Figure 5 is a sectional view taken along lines V-V of figure 3.
Figure 6 depicts a second building block according to the present invention.
Figure 7 is a side view of that which is shown in figure 6.
Figure 8 is a bottom plan view of that which is shown in figure 6.
Figure 9 is a sectional view taken along lines IX-IX of figure 6.
Figure 10 is a sectional view taken along lines X-X of figure 8.
Figure 11 is a perspective view of a plurality of the blocks shown in figures 1 through 10 assembled in a certain manner to show the flexibility and adaptability of various blocks to form and to connect with different adjacent blocks.
Figure 12 is a top plan view of a third form of block.
Figure 13 is a side view of that which is shown in figure 12.
Figure 14 is a bottom plan view of that which is shown in figures 12 and 13.
Figure 15 shows a top plan view of another embodiment.
Figure 16 is a side view of that which is shown in figure 15.
Figure 17 is a bottom view of that which is shown in figures 15 and 16.
Figure 18 depicts another embodiment of block.
Figure 19 is a side view of figure 18.
Figure 20 is a bottom view of that which is shown in figure 18.
Figure 21 is a top plan view of further form of block.
Figure 22 is a side view of that which is shown in figure 21.
Figure 23 is the bottom view of figure 21.
Figure 24 is a top plan view of a boot type accessory for use with the previously described blocks.
Figure 25 is a sectional view taken along lines XXV-XXV of figure 24.
Figure 26 is a bottom view from that which is shown in figure 24.
Figure 27 is a plan view of a further form of block.
Figure 28 is a sectional view taken along lines XXVIII-XXVIII of figure 27.
Figure 29 is an opposite from that which is shown in figure 27. Figures 27-29 operate as a wheel for the apparatus.
Figure 30 is a top plan view of an axle for supporting the wheel shown in figures 27-29.
Figure 31 is a side view of that which is shown in figure 30.
Figure 32 shows the wheel of figures 27-29 deployed on the block of figures 30-31.
Figure 33 is a side view of a further form of block.
Figure 34 is a plan view thereof.
Figure 35 is an opposite side view of that which is shown in figures 33, 34.
Figure 36 is a side view of another form of block.
Figure 37 is a plan view of that which is shown in figure 36.

Figure 38 is an opposite side view of that which is shown in figures 26, 27.
Figure 39 is an end view taken along lines XXXIX-XXXIX of figure 37.
Figure 40 is a side view of a further form of block.
Figure 41 is another side view of that which is shown in figure 40.
Figure 42 is a plan view of that which is shown in figures 40 and 41.
Figure 43 is an opposite side view of that which is shown in figures 40 and 41.
Figure 44 is a top plan view of a further form of block.
Figure 45 is a side view taken along lines XLV-XLV of figure 44.
Figure 46 is an alternate side view.
Figure 47 is a plan view of plurality of blocks oriented and interconnected to simulate a vehicular type of toy.
Figure 48 shows a further assemblage of blocks simulative of a domestic animal.
Figure 49 shows a side view of an airplane.
Figure 50 is a top plan view of figure 49.
Figure 51 is a side view of a bird.
Figure 52 is a side view of a serpent.
Figure 53 is a front plan view of the second major block according to the present invention.
Figure 54 is an oblique perspective of figure 53.
Figure 55 is a side view of figure 53.
Figure 56 is a rear plan view of figure 53.
Figure 57 shows plural figure 56 apparatus interconnected.
Figure 58 reflects various orientations and connections of the apparatus with other like components.
Figure 59 is a sectional view taken along lines LIX-LIX of figure 60.
Figure 60 is a top plan view of the third major block according to one form of the invention.
Figure 61 is a sectional view taken along lines LXI-LXI of figure 60.
Figure 62 is a left side view of that which is shown in figure 60.
Figure 63 is a front view of that which is shown in figure 60.
Figure 64 is a right side view of that which is shown in figure 60.
Figure 65 is a bottom plan view of that which is shown in figure 60.
Figure 66 is a front view detail of a portion of the apparatus.
Figure 67 is a front view detail of another portion of the apparatus.
Figure 68 is a side view of two of the third major type of blocks of the apparatus interconnected.
Figure 69 is a side view of two of the first blocks of the apparatus interconnected.
Figure 70 is a sectional view taken along lines LXX-LXX of figure 71.
Figure 71 is a top plan view of a second block of the third major type according to one form of the invention.
Figure 72 is a sectional view taken along lines LXXII-LXXII of figure 71.
Figure 73 is a left side view of that which is shown in figure 71.
Figure 74 is a front view of that which is shown in figure 71.
Figure 75 is a right side view of that which is shown in figure 71.
Figure 76 is a bottom plan view of that which is shown in figure 71.
Figure 77 is a top plan view of a fourth major block according to one form of the invention.
Figure 78 is a right side view of that which is shown in figure 77.
Figure 79 is a bottom plan view of that which is shown in figure 77.
Figure 80 is a plan view of a plurality of the third and fourth major blocks oriented and interconnected to simulate a planar gear mechanism.
Figure 81 is a plan view of a plurality of the third and fourth major blocks oriented and interconnected to simulate a mechanism combining beveled and planar gears.
Figure 82 is a plan view of a plurality of the third and fourth major blocks oriented and interconnected to simulate a mechanism combining beveled and planar gears.
Figure 83 is a top plan view showing two third major blocks in an attached, aligned and stacked configuration, with only the interfacing attachments shown.
Figure 84 is a top plan view showing the figure 83 blocks in another attached configuration.
Figure 85 is a top plan view showing the figure 83 blocks in another attached configuration.
Figure 86 is a top plan view showing the figure 83 blocks in another attached configuration.
Figure 87 is a top plan view showing the figure 83 blocks in another attached configuration.
Figure 88 is a top plan view showing the figure 83 blocks in another attached configuration.
Figure 89 is a top plan view showing the figure 83 blocks in another attached configuration.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing now, wherein like reference numerals refer to like parts throughout the various drawing figures, reference numeral 10 as shown in figures 1 through 5 is directed to one form of building block.

As shown in these drawings, the element 10 defines a first building block which has plural facets. In its essence, the element 10 includes a top wall 2 which provides a first attachment surface and associated connecting means. Bottom wall 12 provides a second attachment surface with uniting means. A peripheral, channel 20 defines a third attachment area. Note that walls 2 and 12 have a substantially square profile. Thus, the first building element is polygonal and has N sides, where N equals 4.

The top wall 2 is formed with a plurality of wedges 4 which are configured as right triangles oriented such that each right triangle has a hypoteneuse which faces along a diagonal of the block. Thus, there are 2N wedges for a total of 8.

A plurality of spaces 6 extend radially between adjacent wedges 4. These radially extending spaces 6 include deeper recesses 7 and describe the vanes 16 on the opposite side 12 of the block shown in figure 3. 2N spaces are provided which in this example provide a total of 8 spaces.

A central hub 8 is provided with a plurality of radially extending spokes which extend to and are aligned with apices of the wedges 4. As shown, 2N spokes are provided for a total of 8, since N equals 4.

The top surface 2 is circumscribed by a peripheral shelf 1 which includes an upwardly extending peripheral lip 3. The bottom surface 12 is circumscribed by a peripheral shelf 11 which includes an upwardly extending peripheral lip 13. As shown, a lattice 5 extends upwardly from the shelf 1 and of the same dimension or height as the peripheral lip 3. The lattice 5 extends from both the shelf 1 (of the top wall) and the shelf 11 (of the bottom wall). Thus, in section a substantially U-shaped channel is provided where shelves 9 form the legs of the U-shaped channel, and a band 19 serves as the bight portion. Collectively, the channel 20 as it circumscribes the first building element 10 defines a third attachment surface which mates with a projection 40 on a second building element 30 to be discussed. Raised beads 21 are formed on each shelf 9 to coact with a trough 46 described infra. Each shelf 9 has two beads, with one bead 21 concentric to the other. One bead 21 from each shelf 9 defines a pair and are aligned equidistant to the center of the block.

As shown in figures 6 through 10, the second building element 30 conforms in all respects to the first element 10 shown in figures 1 through 5, except for the details associated with the third attachment surface 20 of the first element 10. Thus, the discussion with respect to figures 6 through 10 will focus on a projection 40 which defines a complemental attachment surface for the channel 20 of the first element 10.

The projection 40 and its associated structure causes the second building element 30 to have a configuration somewhat different from the first building element 10. As noted, the projection 40 includes lips 42 extending laterally from all four sides of the second building element, medially disposed between its top wall 22 and bottom wall 32. The lip 42 projects outwardly and finds support from a plurality of ribs 44 extending upwardly from the lip 42 on both top and bottom lip surfaces. The ribs 44 provide strength to the lip 42, retard unwanted flexing and also minimize material to reduce curing time in the mold.

A flange 48 extends perpendicular to the lip 42, circumscribing the lip 42 around all sides of the second building element 30. Had the projection 40 paralleled the contour of the second building element 30, the projection 40 would have had N sides, or as shown, where N equals 4, a quadrilateral. However, corners of the lip 42 and flange 48 have been truncated to provide a 2N structure, in this case an octagonal.

The truncations 52 allow adjacent blocks to be placed in tangential registry such that the lips 3, 13 of the first building element 10 and lips 23, 33 of the second building element 30 can be placed in abutting relationship even at the corners. Stated alternatively, when four building elements 10, 30 are arranged in a 2 x 2 array, such that two building elements 30 and two building elements 10 are connected, the truncations 52 allow clearance for the 2 x 2 array to be interconnected. See the 2 x 2 array shown in figure 11, depicted as "R".

Notice the presence of trough 46. The trough 46 is present on both the top side of the lip 42 and its bottom side. The trough 46 passes not only through the ribs 44, but also through the truncated wall 52 defining a portion of the flange 48. Collectively, the flange 48, the portion of the ribs 44 extending between the flange 48 and the trough 46 define a somewhat bulbous portion which provides one possible first degree of attachment with the channel 20 of figures 1 through 5.

When the projection 40 is inserted within the channel 20 up to an area where the trough 46 is just occluded by the lips 3, 13 extending around the periphery of the building element 10, a form of hinge is provided allowing rotation between the blocks around the direction of the arrow A. See figure 11. This hinge

effect can be enhanced by having bead 21 emanate from the surfaces 9 of the channel 20. When inserting the second building element 30 into the first building element 20, a "snap feel" (auditory - vibratory feedback) is provided by having a first bead 21 nest within trough 46. Further penetration of the projection 40 into the channel way recess 20 provides a rigid interconnection via the second inner bead 21 contacting the trough 46.

In use and operation, the blocks 10, 30 described can be oriented in a multiplicity of ways, some of which have been shown for illustrative purposes in figure 11. It should be noted that with the configuration as described, the width of the vanes 16, 36 and the recesses 6 are complemental to the dimension of the channel 20 and the projections 40. This means that edges 20, 40 of the blocks 10, 30 can be supported on the vanes 16, 36 and recesses 6 of the top and bottom surfaces 2, 12, 22, 32. Thus, these two blocks 10, 30 allow attachment along the edges 20, 40 of adjacent blocks 10, 30, between one edge 20, 40 and a wall 2, 12, 22, 32 of the block 10, 30 and between walls 2, 12, 22, 32 themselves.

Notice also that the blocks 10, 30 are relatively neutral with respect to their ability for overlapping interconnection along arrows "C" and "D". Thus, one quadrant Q (figure 11) of one block 10, 30 can overlap with a quadrant of another block 10, 30 thereby providing a "tie" and imbrications.

In addition, the structure of the blocks 10, 30 is neutral with respect to rotational orientation as about arrow "E" of figure 11. Thus, since the vanes 16, 36 (or recesses 6) radiate from a central portion of each block 10, 30, a side edge 20, 40 of one block can connect with the vane 16, 36 (or recess 6) and be reliably connected along any of the radially emanating vanes 16, 36 (or recesses 6).

Furthermore, the edges 20, 40 can translate along the direction F when connected to a wall 2, 12, 22, 32 of a block 10, 30. Arrow G shows block 10, 30 translation along an edge 20, 40 of two blocks 10, 30.

Figures 12 through 14 reflect a further variation of that which has been delineated hereinabove. More particularly, and with respect to the salient differences, third building element 60 shares greatest similarity with the second building element 30 except that whereas the second building element 30 was a four sided polygon, this third building element 60 has two linear sides, similar to the second building element 30 but these two linear sides are interconnected by an arcuate third side. Thus, the third building element 60 is somewhat triangular in shape, but the "hypoteneuse" portion is curved as is one of the apices forming an acute angle of the modified triangle.

More specifically, reference numerals 53 and 55 correspond to what heretofore would have been corners, particularly when considering the figure 6-10 embodiment. Thus, these points designate arcs on a curve rather than corners. The transition from 53 to 54 on the outer periphery of the third building element 60 reflects a substantially constant radius curve that extends from what heretofore had been a diagonal through an arc of 45 degrees. From point 54 through 55 and 56, the radius of curvature changes so that form point 54 through 55 and on to 56, a generally parabolic curve conforming to the equation $Y = X^2$ will define the curve. Y defines translation vertically (i.e. up and down the paper) and X denotes translation horizontally. Note that the projection 40 circumscribes the third building element 60 as it did the second building element 30. Note the presence of truncations 52 as in the second building element 30, and for similar purposes.

Because the contour of this third building block 60 has been altered when compared with the second building block 30 structure, vanes not on the diagonal (16a) as well as vanes on the diagonal 16 will be affected thereby. Note that in figure 14, one of the diagonal vanes, labeled 16b has been abbreviated, while a corresponding non-diagonal vane 16c has been similarly shortened to accommodate the curvature associated with this third block 60. Similarly, and with respect to figure 12, the triangular wedges 4a, 4b and 4c have been similarly modified to accommodate the curvature along the one wall. Note this version also has a "male" projection 40.

Figures 15 through 17 reflect a fourth building block 70, similar to the third building block 60, but this fourth building block 70 is provided with a comparable recess 20 to that which is shown in figures 1 through 5. Thus, figures 15 through 17 define the "female" counterpart to the "male version" shown in figures 12-14. They are therefore geometrically similar.

Figures 18 through 20 depict a fifth building block 80 which is "male" in that it has a projection 40, but differs from the third building block 60 in that this fifth building block 80 has one of its four corners provided with a constant radius curvature. As shown, the constant radius curvature 82 extends through one quadrant of the polygon. In order to accommodate this modification, only one diagonal vane 16b has been abbreviated, when compared to that which is shown in figure 12 for example or figure 8. Similarly, the wedges 4b adjacent this one corner have also been abbreviated. Thus, for this one quadrant a constant radius curve is provided between points 81 and 83 of this corner.

Figures 21 through 23 depict the "female" counterpart 90 defining a sixth building element.

The modified blocks 60, 70, 80, 90 shown in figures 12 through 23 still retain fidelity with the initial

premise of the blocks 10, 30 shown in figures 1 through 11 in that a toy has been defined having a plurality of facets with a first attachment surface on a top area, a second attachment surface on a bottom area, and a periphery has been provided with a third attachment area. The versions of "accessories" shown in the remaining figures are intended to enhance the blocks heretofore described and are intended to compliment the previously discussed blocks.

More specifically, figures 24 through 26 detail an attachment surface occluding means, configured as cover 100. In essence, the cover 100 includes a top wall 102 of substantially square configuration having a peripherally extending side wall 104 circumscribing the top wall 102. This cover 100 is dimensioned to register over either the vanes 16 or the wedges 4 by having the side walls 104 frictionally engage the outer periphery of the vanes 16 or wedges 4. Note the presence of a crescent shaped opening 106 oriented such that the crescent is disposed in one quadrant of the cover 100. When judiciously applied over a building block, this cover 100 would be simulative of an eye. Note that this cover 100 is dimensioned to work on all of the blocks defined hereinabove, including the third through sixth styles of blocks 60, 70, 80, 90 which have arcuate outer contours. This is made possible by the cover 100 engaging and being retained on the linear side walls of the wedges 4 or ends of the vanes 16. Thus, gaps between side walls of the cover 100 and the abbreviated version of vanes 16 or wedges 4 on the third through sixth building elements 60, 70, 80, 90 are not critical.

With respect to figures 27 through 32, structure is delineated for providing a wheeled undercarriage for certain possible construction of the toy. In its essence, a block 120, having an axle 130 extending out of two side walls 128 thereof support a pair of wheels 110 thereon. The block 120 has a top surface 122 provided with a plurality of wedges similar to the wedges 4 delineated in the first through sixth building blocks 10, 30, 60, 70, 80, 90 and an opposite side 132 with a plurality of radially extending vanes also similar to the previously discussed embodiments. Thus, this block 120 can connect on top and bottom surfaces with other blocks 10, 30, 60, 70, 80, 90. The block 120 is substantially square having the side walls 128 which support the axles 130. For requisite structural rigidity, the axle is embedded within a built up area 126 extending between the side walls 128 and the axle 130. Note axle supporting side walls 124 have a smooth outer contour and therefore do not provide any attachment surface as had been provided with previously discussed building blocks.

The axle 130 is provided with a central longitudinally extending slit 134 and a bulbous end 136 provided with a radially extending shelf 138 between the axle shaft 130 and the bulbous end 136. Its function, when considered in combination with the wheels 110 will make the bulbous end 136, its notch 138 and axle 130 evident.

The wheel 110 includes an outer surface 112 of substantially annular configuration to provide rolling contact on a support surface (not shown). A disc shaped outer wall 114 provides the simulated wheel configuration, and a wheel well 118 is recessed within the disc outer wall 114 by virtue of an inwardly directed band 108 extending from the disc 114 to the well 118. The well 118 serves as a step which in turn communicates with a sleeve 116 having an inner diameter dimensioned somewhat similar to the outer diameter of the axle 130.

In order to install the wheel 110 on the axle 130, the shaft 130 must be compressed along the direction of the double ended arrow H, provided by the opening 134 on the shaft 130. Thus, the shaft 130 deforms by collapsing inwardly to be placed within the sleeve 116. The bulbous end 136 of the shaft 130 forces the collapsing of the axle 130 as described. However, once the bulbous end 136 passes beyond the sleeve 116, the shaft 130 expands and retains its initial configuration, firmly residing within the sleeve 116 and allowing rotation of the wheel 110 about the axle 130. The abutment 138 assures that the wheel 110 will remain fixed. Given this structure, the wheels 110 are not removable.

With respect to figures 33 through 35, another form of accessory, a parabolic block 140 is shown. In essence, this block 140 includes a linear top wall 145, a side wall 40 having a projection extending outwardly therefrom, not dissimilar from the projection 40 shown in figures 6 through 10, wherein the projection 40 includes a trough 46, ribs 44 and a peripheral end wall 48 provided with truncations 52, and a parabolic end wall. The end wall includes an area of constant radius curvature 147 and a curved portion 149 which corresponds to the equation $y = x^2$. This accessory block 140 has a top wall and a bottom wall. The top wall includes a horizontally extending vane 142 having the same thickness as the vanes 16 of the previous embodiments. Thus, this vane 142 can be placed within and attached to either a channel 20 or within recesses 14 provided between wedges 4. The opposite side of the attachment block 140 includes a pair of spaced parallel vanes 144. These vanes 144 are spaced sufficiently to receive a projection 40 therewithin. In addition, these spaced parallel vanes 144 have the requisite thickness to frictionally receive therewithin other vanes 16.

With respect to figures 36 through 39, the "female" counterpart of the figure 33-35 embodiment is

provided. Thus, this second attachment block 150 includes top and bottom walls having a single vane 142 on one wall and a double vane 144 on an opposite wall, similar to the figure 33-35 embodiment. Rather than the projection 40, that edge is provided with the channel 20 which can receive therewith either a vane 16 or a projection 40. The remaining side walls include a smooth linear top-side wall 155 and smooth arcuate end wall 157 and a further smooth arcuate end wall 159 having similar slope as the previous embodiment. Thus, the arcuate side walls 157 and 159 correspond to the equation $y = x^2$.

With respect to figures 40 through 43, another form of accessory block 160 is shown, a "male" block with projection 40 on one side wall. In addition, the vanes 142 and 144 are on opposed top and bottom walls for similar purposes set forth with respect to the first attachment block 140. However, this block is somewhat trapazordal in configuration having one long wall 162 and opposed wall 166 canted towards the one long wall 162, and an interconnecting truncated wall 164. This block 160 may be described as a "nose" piece which has particular utility when creating elements simulative of vehicles.

Figures 44 through 46 reflect the "female" counterpart to the last described block 160. It too has one long wall 172, a wall 176 canted towards the long wall 172 on an opposite side, this canted wall 176 declinated towards the long wall 172 and a truncated wall 174 interconnecting the top and bottom walls 172, 176. The channel 20 allows connection of this block 160 with other blocks.

The drawing figures 47 through 52 reflect the utilization of these various blocks in different configurations illustrating their ability to simulate other objects. These orientations are merely illustrative and are not intended to be limiting. The reference resembles are directed generally to the blocks that constitute some of the possible combinations.

For example, figure 47 depicts a vehicle. Figure 48 is evocative of a domestic animal. Figure 49 is a side view of an airplane.

Figure 50 is a top plan view of that which is shown in figure 49 and figure 51 is evocative of a bird from a side view.

Figure 52 is a side view of a serpent.

Referring now to drawings 53 through 58 reference numeral 210 is directed to the humanoid figurine defining the construction toy in its second major form.

In essence, the humanoid figurine 210 is a construction toy that is generally wafer-shaped. The toy can include a torso having a front wall 202 and a rear wall 212. Extending up from the torso is a head 220. Legs 230 extend from a portion of the torso opposite from the head 220. Arms 240 extend out from sides of the torso such that the figurine toy 210 generally approximates the external contour of the human physique but is suggestive of a robot-like creature.

More particularly, the figurine toy 210 and its torso includes a front wall 202 and a rear wall 212 which respectively define first and second attachment surfaces. These attachment surfaces are complemental, one to the other, so that a topographic outwardly projecting contour on one wall also defines a recess on an opposite wall. Thus, when the toy is formed with known plastic forming techniques, registry between a plurality of toys is assured so that the first and second attachment surfaces collectively define complemental connecting means. Generally, the torso portion approximates the structure of the first major block so that these humanoid figurines 210 can coact and connect with the blocks described therein.

The front wall, shown in figures 53 and 54 for example, include a plurality of wedges 204 emanating from a center 208. The center 208 includes spokes radiating towards apices of the wedges 204 which are nearest the center 208 of the torso. The wedges 204 define substantially right-angle triangles wherein a hypotenuse of each triangular wedge 204 is oriented along a diagonal of the substantially square-shaped torso. If the torso were viewed as a quadrilateral, wherein the number of sides N equals 4, 2 N wedges are present. Spaces 206 are provided between adjacent wedges 204. These spaces 206 extend radially as shown in figure 53. Centrally disposed within each space 206 is a recess 207 extending more deeply into the torso than the spaces 206 extend. When viewing figure 56, these deeper recesses 207 appear as vanes 216 extending radially from a hub 218 of the rear wall 212.

More particularly, the rear wall 212, shown in figure 56, which defines the second attachment surface provides complemental connecting means with the first attachment surface defined by the front wall 202. The rear wall 212 includes a plurality of radially extending vanes 216 separated one from the other by a plurality of substantially triangular shaped spaces 214 having deeper recesses 217. Collectively, these deeper recesses 217 and the spaces 214 describe the wedges 204 which appear on the front wall 202 of figure 53. Thus, the vanes 216 are formed by both the spaces 206 and deeper recesses 207 of the front wall 202. Walls 202, 212 are thus assured of being stacked with respect to the connecting means defining the first attachment surface and the second attachment surface. The hub 218 is similar to the center 208, and the spokes which emanate from the hub 218 are also similar to that which is shown in figure 53. Thus, each of the vanes extend radially. As before, since the torso is substantially quadrilateral shaped, 2N vanes

216 are provided emanating from the hub 218. Since N equals 4, eight vanes radially emanate, defining two cruciform sets, with one set occupying the diagonals of the rear wall 212 and the second set rotated 45 degrees therefrom providing substantially vertical and horizontal vanes 216 when viewed in figure 56.

Thus formed, the torso portion bears striking similarity and shares most of the attributes of the blocks described in the first major block. As such, these blocks are quite compatible with the blocks described in the first major block as suggested in figure 58 which shows the figurine 210 interacting not only with other figurines 210, but also with blocks referred to as the first major block.

Figures 53 thru 57 also depict certain features inherent with the head portion 220 integrally formed with the humanoid figurine 210 and extending upwardly from the torso. In general, the head 220 emulates the facial expressions evocative of a human being. Thus, facial indicia such as eyes 222 and a mouth 223 are provided on a substantially planar surface 221 defining the head 220. The eyes 222 and the mouth 223 can be formed as apertures passing through the planar surface 221, and the facial effect may be enhanced by raised projections or recesses on this portion of the head. A circumscribing peripheral ridge 224 denotes the outer boundary of the head 220. As shown, the head and its peripheral ridge 224 generally have a bulbous lower portion evocative of jowls adjacent what would constitute a neck in a humanoid figurine. The jowls taper inwardly upwardly and then a flattened top portion defines a top of the head 220. The peripheral ridge 224 and planar surface defining the head collectively provide a first fastening means since, as shown in figure 55, the width thereof is adapted to frictionally be retained within the spaces 206 on the front torso and on other areas to be defined. This first fastening means therefore allows plural toys to be interconnected.

In addition, a plurality of legs 230 extend downwardly from the torso to further enhance the impression of the figurine having human attributes. The legs 230 include planar stock portions 234 which are reinforced by webbing 232 which is raised up from the planar stock 234, enhancing the rigidity of the legs 230. In general, the legs 230 are circumscribed by an outboard bead 238 having the same raised characteristics of the webbing 232. In essence, the legs 230 are provided in two pairs of planar stock 234 and associated webbing 232. A first pair of planar stock 234 defines a single leg 230 in which the two planar stock portions 234 are separated one from the other by means of a groove 236, as shown in figure 55. Thus, for the sake of description, two "vertical" planar stock elements 234 are spaced apart in different vertical planes such that a groove 236 is provided having a clearance complemental to the thickness, for example, of a plurality of other types of connectors. This defines a second fastening means the clearance of which accommodates, for example the thickness of the peripheral ridge 224 of the head 220, and the width of the vanes 216 on the torso. A similar groove 239 exists between one leg 230 and the other, as shown in figure 56 for example. The clearance of groove 239. like the groove 236, accommodates other toys for interconnection therebetween. Groove 239 defines a third fastening means. Thus, the first and second legs 230 are spaced one from the other by means of a groove 239. Each leg 230 is formed from a pair of planar stock elements 234 and each leg 230 extends from the torso. Thus a pair of legs 230, formed from a pair of planar stock elements 234 is provided. See figure 53 and figure 56.

Attention is now directed to the drawing figures which delineate certain structure with respect to the arms 240. general, each arm 240 includes planar portion 242 emanating outwardly from the torso. The planar portion 242 is circumscribed by a peripheral lip 244. The general contour is simulative of an arm having a hand which, while lacking the definition of a hand in that no fingers are shown, has the contour of the hand were it to have worn a mitten. The peripheral lip 244 and the planar portion 242 collectively define a thickness as shown in figure 55 which is substantially identical to the thickness of the peripheral ridge 224 associated with the head 220. This means that the peripheral lip 244 and planar portion 242 define a fourth fastening means which can fit within the groove 236 (i.e. the second fastening means of the leg 230) or the grooves 239 (i.e. the third fastening means of the leg 230) as well as between the wedges 204 by fitting in the spaces 206. The arms 240 also include a pair of spaced locking ribs 246 emanating from a "front" portion of the arm 240 as oriented in figure 53. The spaced locking ribs 246 are substantially vertically oriented planar ribs spaced apart such that a gap 249 is provided therebetween. As should now be evident, the gap 249 is chosen to provide a fifth fastening means because its width is complemental to the dimension of the vanes 216 on the back of the torso as well as the thickness of the head 220 defined by the peripheral ridge 224 and the other similarly dimensionally related structure previously enumerated. In addition, the arms 240 include a locking tab 248 directed rearwardly from the back of the arm 240, as shown in figure 56. The locking tab 248 has the thickness of the peripheral ridge 224 of the head 220 and therefore can be accommodated by the spaces 206 and groove 236, 239, gap 249 etc. The locking tab 248 and the locking ribs 246 as shown in figure 55 extend outwardly in a substantially vertical plane. They are provided with cruciform shaped reinforcement 247 to provide rigidity for these ribs 246 and tab 248. The tab 248 provides a sixth fastening means.

In use and operation, the figurine 210 according to the present invention lends itself to deployment in a plurality of diverse manners, some of which are illustrated in figures 57 and 58. As shown in figure 57, a series of figurines can be linked serially by "holding hands "with adjacent figurines oriented in different vertical planes by the interlocking relationship of the tabs 248 and locking ribs 246 defining respectively the sixth and fifth fastening means. In addition, the lower left hand corner of figure 58 reflects the "neutrality" inherent with the torso of the front and rear walls, 202, 212 of the instant invention and shared by the first major block. That is, because the wedges 204, spaces 206 and vanes 216 emanate radially from a center of the torso, they are a relatively neutral and allow rotation of the figurines 210, one with respect to another. Other attributes are illustrated in the drawing figures.

Referring now to the drawings of figures 59 through 89 throughout, reference numeral 310 is directed to the third major block, shown in detail in figures 59 through 67. In essence, a mounting block 310 is substantially a wafer-shaped construct having a top surface 311, a bottom surface 312 and a plurality of long side surfaces 314 and short side surfaces 315. The top surface 311 has a plurality of posts 340. The bottom surface 312 has a plurality of channels 350 (Figure 65). The side surfaces 314, 315 have either a prominence 370 or an orifice 380 positioned thereon. The posts 340 are configured to fasten within the channels 350 and the prominences 370 are configured to fasten within the orifices 380 allowing a plurality of mounting blocks 310 to be attached together in a variety of ways, as shown in figure 80 and figure 81.

More particularly, the mounting block 310 includes a top surface 311 and a bottom surface 312 which respectively define first and second attachment surfaces. These attachment surfaces are complemental, allowing a plurality of mounting blocks 310 to be connected top-to-bottom in a series.

The attachment means of the top surface 311 includes a plurality of posts 340, shown in detail in figure 66, configured in rows 342 that radiate outwardly from a center of the top surface 311. Each post 340 is a substantially cylindrical construct fixedly attached on a first flat end 341 to the top surface 311 and extending outwardly perpendicular to the top surface 311. Each post 340 is of similar diameter and each row 342 is substantially linear, such that any flat surface placed against side walls 345 of the posts 340 may have a point of tangency with each of the posts 340 in the row 342.

Preferably, each post 340 has a toroidal flair 344 circumscribing the side wall 345 near a second flat end 343, as shown in detail in figure 66. The toroidal flair 344 lies in a plane parallel to the top surface 311.

Also on the top surface 311, linear webbing 390 is formed in a variety of positions beneath the top surface 311. A top edge of the linear webbing 390 conforms to a plane coextensive with the top surface 311 and defining the exact location of the top surface 311. The linear webbing 390 provides added structural strength to the mounting blocks 310, reduces the volume of plastic used in manufacture, shortens the plastic cycle time in molding and helps define the top surface 311.

The attachment means of the bottom surface 312 includes a plurality of channels 350, shown in detail in figure 67, that radiate outwardly from a center of the bottom surface 312. Each of the channels 350 is formed from a pair of parallel walls 352 which are preferably rectangular plates which extend downward orthogonally from said bottom surface 312. Each wall 352 has an inside surface 354 which faces the opposite wall of the pair. Fixedly attached to each of the inside surfaces 354 is a ledge 356. The ledge 356 is a radiused linear formation of uniform thickness and uniform distance from the bottom surface 312, which extends longitudinally along the entirety of the inside surface 354.

The ledge 356 is located a distance from the bottom surface 312 equal to a distance from the toroidal flair 344 to the second flat end 343 of the post 340. The walls 352 of the channel 350 are a distance apart substantially equal to the diameter of the posts 340. Therefore, when two mounting blocks 310 are oriented with a top surface 311 and bottom surface 312 coming into contact, the posts 340 will detachably attach securely within the channels 350 with the toroidal flair 344 directly above and adjacent to the ledge 356, shown in figure 80, figure 81 and figure 83.

Preferably, the mounting blocks 310 are of rectangular cross-section when viewed from above the top surface 311, as shown in figure 60, having two long side surfaces 314 and two short side surfaces 315. Preferably, the mounting blocks 310 have four rows 342 of posts 340 with each row 342 being oriented orthogonal to a side surface 314, 315. The rows 342 which are perpendicular to short side surfaces 315 have three posts 340 in each row 342 and the rows 342 perpendicular to long side surfaces 314 have two posts 340 in each row 342. Preferably, the bottom surface 312 is configured with four channels 350, each channel 350 being perpendicular to a side surface 314, 315. In this configuration, the posts 340 are aligned on the top surface 311 directly above the channels 350 on the bottom surface 312.

The posts 340 are located a uniform distance apart from each other. This allows a mounting block 310 to connect to another mounting block 310 in various rotationally distinct top-to-bottom configurations. Some variations are shown in detail in figures 83 through 89. When configured in this way, posts 340 from the same row 342 may even attach within separate channels 350 of an adjoining mounting block 310.

Each of the side surfaces 314, 315 of the mounting blocks 310 is equipped with either a prominence 370 or an orifice 380. The prominence 370 and the orifice 380 are of complemental shape allowing the prominence 370 to attach within the orifice 380, as shown in figures 68 and 69, thereby linking separate mounting blocks 310 through their adjoining side surfaces 314, 315.

The prominence 370 is substantially a cylindrical construct having a hollow core 376. The prominence 370 may extend outwardly orthogonally from either side surface 314, 315. The prominence 370 has a curved outer side wall 378 with a plurality of ribs 374 fixedly attached thereto extending along the side wall 378 in a direction perpendicular to the side surface 314, 315.

A plurality of slits 372 are formed in the prominence 370 extending from the hollow core 376 to the side wall 378 and completely bisecting the prominence 370 in a plane perpendicular to the side surface 314, 315, as most clearly shown in figure 64. The hollow core 376 has an inner region 375 (figure 60) adjacent to the side surface 314, 315 and an outer region 377 outward from the inner region 375. The inner region 375 of the core 376 has a width greater than the width of the outer region 377 of the core 376. The core 376 is of substantially similar diameter as is the diameter of the post 340 of the top surface 311.

Two mounting blocks 310 may be connected by inserting the post 340 of the top surface 311 of one mounting block 310 into the core 376 of the side surface 314, 315 of another mounting block 310. The toroidal flair 344 of the post 340 can insert within the inner region 375 by deflecting the prominence along arrow "B". This allows the post 340 and attached mounting block 10 to rotate relative to the core 376 of the prominence 370 and attached mounting block 10.

The orifice 380 is substantially a cylindrical recess which extends inwardly orthogonally from the side surface 314, 315. The orifice 380 has a curved side wall 388 with a plurality of undulations 384 formed thereupon and oriented to extend in a direction perpendicular to the side surface 314, 315. Each undulation 384 extends from the side surface 314, 315, inward toward a center of the mounting block 310. A circular, yet serpentine recess is thus formed.

Therefore, when two mounting blocks 310 are oriented with the side surfaces 314, 315 adjacent to each other, the prominence 370 in the one side surface 314, 315 may fit within the orifice 380 in the other side surface 314, 315 by deflecting the prominence 370 in the direction opposite from arrow "B" (see figure 64). The ribs 374 of the prominence 370 fit complementally with the undulations 384 of the orifice 380 restricting the two mounting blocks 310 from relative rotation. Because each rib 374 is of uniform width and uniform distance from adjacent ribs 374 and because each undulation 384 is of uniform width and uniform distance from adjacent undulations 384, the side surfaces 314, 315 of adjoining mounting blocks 310 may connect through the prominence 370 and orifice 380 in a variety of different orientations by rotation of one of the mounting blocks 310 relative to another of the mounting blocks 310 about an axis co-linear with a center axis of the prominence 370 and the orifice 380, as shown in figures 68 and 69.

Preferably, one of the short side surfaces 315 of the mounting block 310 is equipped with a prominence 370 located at the center of the short side surface 315. The other three side surfaces 314, 315 are all equipped with orifices 380. On the short side surface 315 the orifice 380 is centrally located, but on the long side surfaces 314 the orifices 380 may be located nearest to the short side surface 315 having the orifice 380. All of the orifices 380 are located an equal distance from corners between the side surfaces 314, 315 which have orifices 380, for reasons to be explained later.

Reference numeral 320 is directed to a driving block, shown in detail in figures 70 through 76. In essence, the driving block 320 is substantially a wafer-shaped construct having a top surface 321, a bottom surface 322 and a plurality of side surfaces 324, 325. Similar to block 310 of figures 59 through 69, the top surface 321 has a plurality of posts 340. The bottom surface 322 has a plurality of channels 350 (figure 76). The side surfaces 324, 325 have either a prominence 370 or an orifice 380 on each side surface 324, 325. The posts 340 are configured to fasten within the channels 350 and the prominences 370 are configured to fasten within the orifices 380 allowing a plurality of driving blocks 320 to be attached together in a variety of ways.

More particularly, the driving block 320 includes a top surface 321 and bottom surface 322 which respectively define first and second attachment surfaces. These attachment surfaces are complemental allowing a plurality of driving blocks 320 to be connected top-to-bottom in a series.

The attachment means of the top surface 321 is a plurality of posts 340, shown in detail in figure 66, configured in rows 342 that radiate outward from a center of the top surface 321. Each post 340 is a substantially cylindrical construct fixedly attached on a first flat end 341 to the top surface 321 and extending outwardly perpendicular to the top surface 321. The geometry of the posts 340 is described more specifically hereinabove in connection with the description of the mounting blocks 310.

Also on the top surface 321, linear webbing 390 is formed in a variety of positions beneath the top surface 321, shown in figure 71. A top edge of the linear webbing 390 conforms to a plane coextensive with

the top surface 321 in defining the exact location of the top surface 321. The linear webbing 390 provides added structural strength to the driving blocks 320 and helps define the top surface 321.

The attachment means of the bottom surface 322 is a plurality of channels 350, also shown in detail in figure 67, that radiate outward from a center of the bottom surface 322. The geometry of the channels 350 is described more specifically hereinabove in connection with the description of the mounting blocks 310.

A ledge 356, shown in detail in figure 67, is located a distance from the bottom surface 322 equal to a distance from a toroidal flair 344, shown in detail in figure 66, to the second flat end 343 of the post 340. Walls 352 of the channel 350 are a distance apart substantially equal to the diameter of the posts 340. Therefore, when two driving blocks 320 are oriented with a top surface 321 and a bottom surface 322 coming into contact, the posts 340 will detachably attach securely within the channels 350 with the toroidal flair 344 directly above and adjacent to the ledge 356.

Preferably the driving blocks 320 are of rectangular cross-section when viewed from above the top surface 321, as shown in figure 71, having two long side surfaces 324 and two short side surfaces 325. Preferably, the driving blocks 320 have four rows 342 of posts 340 with each row 342 being oriented orthogonal to a side surface 324, 325. The rows 342 which are perpendicular to short side surfaces 325 have two posts 340 in each row 342 and the rows 342 perpendicular to long side surfaces 324 have two posts 340 in each row 342. Preferably, the bottom surface 322 is configured with four channels 350, each channel 350 being perpendicular to a side surface 324, 325. In this configuration, the posts 340 are aligned on the top surface 321 directly above the channels 350 on the bottom surface 322.

The posts 340 are located a distance apart from each other which allows a driving block 320 to connect to another driving block 320 in various rotationally distinct top-to-bottom configurations. When configured in this way, posts 340 from the same row 342 may attach within separate channels 350 of an adjoining driving block 320.

Each of the side surfaces 324, 325 of the driving blocks 320 is equipped with either a prominence 370 or an orifice 380. The prominence 370 and the orifice 380 are of complemental shape allowing the prominence 370 to attach within the orifice 380, thereby linking separate driving blocks 320 through their adjoining side walls 324, 325. The geometry of the prominences 370 is described more specifically hereinabove in connection with the description of the mounting blocks 310. The geometry of the orifices 380 is described more specifically hereinabove in connection with the description of the mounting blocks 310.

When two driving blocks 320 are oriented with side surfaces 324, 325 adjacent to each other, the prominence 370 in the one side surface 324, 325 may fit within the orifice 380 in the other side surface 324, 325. The ribs 374 of the prominence 370 fit complementally with the undulations 384 of the orifice 380 restricting the two driving blocks 320 from relative rotation. Because each rib 374 is of uniform width and uniform distance from adjacent ribs 374 and because each undulation 384 is of uniform width and uniform distance from adjacent undulations 384, the side surfaces 324, 325 of adjoining driving blocks 320 may connect through the prominence 370 and orifice 380 in a variety of different orientations by rotation of one of the driving blocks 320 relative to another of the driving blocks 320 about an axis co-linear with a center of the prominence 370 and the orifice 380.

Preferably, one of the long side surfaces 324 of the driving block 320 is equipped with a prominence 370 located at the center of the long side surface 324. The other three side surfaces 324, 325 are all equipped with orifices 380. On the long side surface 324 the orifice is centrally located, but on the short side surfaces 325 the orifices 380 may be located nearest to the long side surface 324 having the prominence 370. All of the orifices 380 are located an equal distance from corners between the side surfaces 324, 325 which have orifices 380, for reasons to be explained later.

The driving block 320 and mounting block 310 are of similar design except for the difference in proportional length between the short side surfaces 325 and and the long side surfaces 314. Thus, the two blocks 310, 320 may function similarly in many ways.

Reference numeral 330 is directed to a gear block 330, the fourth major block, shown in detail in figures 77 through 79. In essence, the gear block 330 is substantially a wafer-shaped construct having a top surface 331, a bottom surface 332 and a side surface 333. The top surface 331 has a plurality of posts 340. The bottom surface 332 has a hub 360. The side surface 333 has a plurality of beveled gear teeth 334 fixedly attached thereto. The posts 340 are configured to fasten within the channels 350 of the mounting blocks 310 and the driving blocks 320. The hub 360 is configured to fasten within the orifices 380 of the mounting blocks 310 and the driving blocks 320 allowing a plurality of gear blocks 330 to be attached to mounting blocks 310 and driving blocks 320 in a variety of ways, shown in figures 322 and 323.

More particularly, the gear block 330 includes a top surface 331 and a bottom surface 332 which respectively define first and second attachment surfaces.

The attachment means of the top surface 331 is a plurality of posts 340, shown in detail in figure 66, configured in rows 342 that radiate outward from a center of the top surface 331. Each post 340 is a substantially cylindrical construct fixedly attached on a first flat end 341 to the top surface 331 and extending outwardly perpendicular to the top surface 331. The geometry of the posts 340 is described more specifically hereinabove in connection with the description at figure 66 of the mounting blocks 310.

Preferably, the gear blocks 330 have four rows 342 of posts 340 with each row 342 being orthogonal to adjacent rows 342. Preferably, each row 342 has two posts 340.

Also on the top surface 331, radially extending linear webbing 390 is formed in a variety of positions beneath the top surface 331, as shown in figure 77. A top edge of the linear webbing 390 conforms to a plane coextensive with the top surface 331 and defining the exact location of the top surface 331. Also on said top surface 331, circular webbing 393 is formed beneath the top surface 331, as shown in figure 77. A top edge of the circular webbing 393 conforms to a plane coextensive with the top surface 331 and defining the exact location of the top surface 331. The circular webbing 393 encircles each post 340 that is at an outer end of any of the rows 342 radially away from a center of the top surface 331. The encircled post 340 is at the center of the circular webbing 393. The linear webbing 390 and circular webbing 393 provide added structural strength to the gear blocks 330 and help define the top surface 331. The circular webbing 393 also supports any connection to an encircled post 340 as shall be evident.

The attachment means of the bottom surface 332 is a hub 360. The hub 360 is a hollow cylindrical construct located in a center of the bottom surface 332 of the circular gear blocks 330. The hub 360 extends downward perpendicularly from the bottom surface 332. The hub 360 has a plurality of slits 362 formed in the side wall 368 of the hub 360 in a plane perpendicular to the bottom surface 332. A lip 364 is formed on an end of the hub 360 opposite the bottom surface 332 which extends radially outwardly from the side wall 368.

The hub 360 is of similar diameter and length to the prominence 370 of both the mounting blocks 310 and the driving blocks 320, allowing connections as shown in figures 80, 81 and 82. Thus, the hub 360 may fit within the orifice 380 of the mounting blocks 310 or the driving blocks 320. The lip 364 of the hub 360 fits into the orifice 380 adjacent to the side surface 314, 315 or the side surface 324, 325. The side wall 388 of the orifice 380 is slightly shorter than the length of the hub 360. When the hub 360 is placed within the orifice 380 the lip 364 resides beyond the side wall 388, thus retaining the hub 360 within the orifice 380. The hub 360 preferably does not have ribs 374 and so the hub 360 is free to rotate within the orifice 380 about arrow "A" (see figure 79). In this manner, a gear block 330 may attach to a mounting block 310 or a driving block 320 in a manner allowing rotation but restricting axial translation.

The posts 340 are located a distance apart from each other which allows a mounting block 310 to connect to a gear block 330 in various rotationally distinct top-to-bottom configurations. When configured in this way, posts 340 from the same row 342 of the gear block 330 may attach within separate channels 350 of an adjoining mounting block 310.

The gear block 330 has a plurality of beveled gear teeth 334 fixedly attached to the side surface 333. Each tooth 334 extends radially outwardly perpendicular to the side surface 333. The teeth 334 are separated from each other by a uniform distance such that gaps 335 between the teeth 334 are similar in width to the width of the teeth 334. This allows adjacent gears 330 to mesh in driving relation. Each tooth 334 is beveled between the side surface 333 and the bottom surface 332 at an angle ò.

Each gear block 330 is of similar size and has teeth 334 similar size such that two distinct gear blocks 330 may be placed adjacent to each other with the teeth 334 of the one gear block 330 fitting within the gap 335 of the other gear block 330. The two gear blocks 330 may interface in planes parallel to each other. They may also interface in two separate planes of the beveled gears 334. In this case, the angle between the two planes is equal to two times the angle ò of each beveled gear 334 of each connected gear block 330 (see figure 82).

Preferably, the beveled angle ò will be 45° causing the two planes to be orthogonal. This allows the two gears 330 to interface at right angles to each other, as shown in figure 82 and figure 83. When one interfacing gear block 330 is rotated, the other interfacing gear block 330 is caused to rotate. This action helps the user of the invention to better grasp the function of many mechanical devices.

The interaction of the various blocks 310, 320 and 330 can now best be appreciated in view of the aforedescribed structure. The length of the long side surface 314 of the mounting block 310 is substantially equal to the diameter of a pitch circle 336 (figure 79) of the gear block 330. When two mounting blocks 310 are connected to each other along complemental short side surfaces 315, two orifices 380, one from each mounting block, are arranged capable of receiving two hubs 360 from two distinct gear blocks 330. The teeth 334 of the gear blocks 330 then interface together in an operative orientation. Furthermore, additional mounting blocks 310 and gear blocks 330 may be added to the first set of mounting blocks 310 and gear

blocks 330 along both side surfaces 314, 315, top surfaces 311 and bottom surfaces 312 allowing gear blocks 330 mounted in orifices 380 to interact as shown in figures 80 and 81.

Also, three driving blocks 320 may be connected along side surfaces 324, 325 allowing two gear blocks 330 with hubs 360 mounted in orifices 380 of the two outside driving blocks 320 to interact in a fashion similar to that of a pair of mounting blocks 310.

Preferably, the distance from the orifice 380 located on the long side 314 to a corner 395 (e.g. figure 60 or 71) adjoining the short side surface 315 with the orifice 380 is equal to the distance from the orifice 380 of the short side surface 315 to the corner 395. Preferably, this distance between orifice 380 and corner 395 is equal to the radius of the pitch circle 336 (figure 79) along the bottom surface 332. This allows two gear blocks 330 to fit into orifices 380 on adjacent side surfaces 314, 315 of the mounting blocks 310 in a way allowing the teeth 334 of the gear blocks 330 to interface. In this configuration, two gear blocks may interface while at right angles to each other, approximating the action of a beveled gear pair, as shown in figure 81.

The core 376 of the prominence 370 of the driving block 320 or the mounting block 310 may be attached over the encircled post 340 on the top surface 331 of the gear block 330, as shown in figure 81. In this configuration, the driving block 320 or the mounting block 310 may act as an input driver for an assemblage of interfacing gear blocks 330. The driving block 320 or the mounting block 310 can rotate relative to the post 340 of the gear block 330, allowing a user to firmly grasp the driving block 320 or mounting block 310 while rotating the gear blocks 330. The circular webbing 393 which surrounds the posts 340 of the gear block 330 helps hold the prominence 370 of the driving block 320 or the mounting block 310 in place while the gear block 330 is rotated.

Moreover, having thus described the invention, it should be apparent that numerous structural modifications and adaptations may be resorted to without departing from the scope and fair meaning of the instant invention, as set forth hereinabove and as described hereinbelow by the claims.

Claims

Claim 1 - A building block characterized by a top wall (2), a bottom wall (12) and a periphery (20) between said top and bottom wall, said top wall defining a first attachment surface, said bottom wall defining a second attachment surface, said first and second attachment surfaces defining complemental, interconnecting contours of at least one radiating vane (16) of constant width on one said wall frictionally fit within a complementally formed space (6) on another said wall, and said periphery defines a third attachment surface.

Claim 2 - A wafer-shaped toy, characterized by: a top wall (2) including a plurality of uniform width, radially extending vanes (16), a bottom wall (12) including a plurality of uniform width, radially extending spaces (6) dimensioned to frictionally receive said vanes therewithin, and a peripheral edge extending between said top and bottom walls provided with means (20 or 40) for linking said edge with another said wafer.

Claim 3 - A toy construction set formed from plural elements characterized by: a plurality of facets defining an exterior of a first said element (30), means at constant width on said facet for connecting (36) said first element to a second element (10), said second element having multiple facets defining an exterior and provided with uniting means (6) to frictionally receive said connecting means, whereby said uniting and connecting means allow said first and second element to be linked.

Claim 4 - A figurine construction toy characterized by:
a front wall (202) defining a first attachment surface,
a rear wall (212) having a second attachment surface,
said first and second attachment surfaces defining complemental connecting means (206, 216),
a top simulative head area (220) extending up from said front and rear walls having a thickness (224) defining a first fastening means (224),
two pairs of legs (230) extending down from said front and rear walls having means defining a second (236) and third (239) fastening means,
and one pair of arms (240) extending from said front and rear walls having means defining fourth (244), fifth (249) and sixth (248) fastening means.

Claim 5 - A construction toy, characterized by:
a wafer having a front wall (202), a rear wall (212) and a periphery defining a torso,
complemental radially extending attachment means of uniform width on said front and rear walls,
said periphery including extensions emanating therefrom provided with plural fastening means for attachment to other construction toys.

Claim 6 - A building block characterized by a top surface (311), a bottom surface (312) opposite said top surface and a plurality of side surfaces (314, 315), said top surface being equipped with a plurality of circular posts (340) of equal diameter and length extending upwardly from said top surface in a plurality of linear rows (342) which extend from a center of said top surface, said bottom surface being equipped with attachment means (350) whereby multiple blocks are interconnectable via said posts and said attachment means.

Claim 7 - A toy construction set of distinct blocks characterized by:

a plurality of primary blocks (310) having a top surface (311), a bottom surface (312) and side surfaces (314, 315); said top surface having an attachment means (340) and said bottom surface having an attachment means (350) which complements said top surface attachment means allowing said top surface of one of said primary blocks to connect to said bottom surface of another of said primary blocks, and said side surfaces having either a first attachment means (375) or a second attachment means (380) which are complemental to each other allowing one said side surface of one said primary block with said first attachment means to connect with another said side surface of another said primary block with the said second attachment means; and

a plurality of gear blocks (330) having a top surface (331), a bottom surface (332) and a circular side surface (333); said top surface having an attachment means (340) and said side surface having an interfacing means (334) allowing one said gear block to tangentially contact another said gear block such that when one said gear block rotates another said gear block may also be rotated;

whereby a combination of said blocks may be created in a variety of interesting and educational configurations.

Claim 8 - A construction toy characterized by:

a plurality of construction blocks (310, 320) having multiple facets,

one said facet on each said block having a prominence (370) projecting from said facet, said prominence including means to allow deflection of said prominence both centrally inwardly and outwardly,

and means for securing said facet bearing said prominence to another said facet of another said block.

Claim 9 - A construction toy characterized by:

a plurality of construction blocks having multiple facets,

one said facet on each said block including a plurality of posts (340) projecting from said facet,

said post including retention means (344) circumscribing said post for fastening to another said facet of another said block.

Claim 10 - A construction toy characterized by:

a plurality of construction blocks (330) having multiple facets,

including a gear block, one said facet on one said gear block having gear teeth (334) with planar and orthogonal meshing means to mesh with gear teeth on another said gear block having similar meshing means.

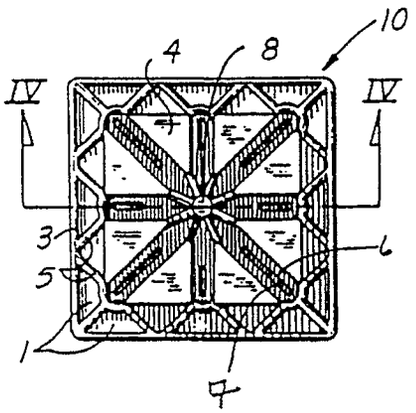


FIG. 1

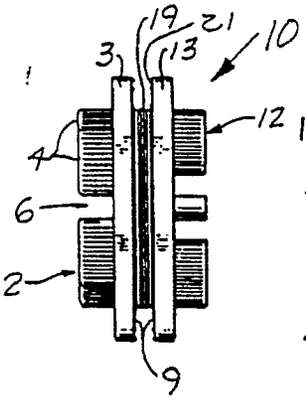


FIG. 2

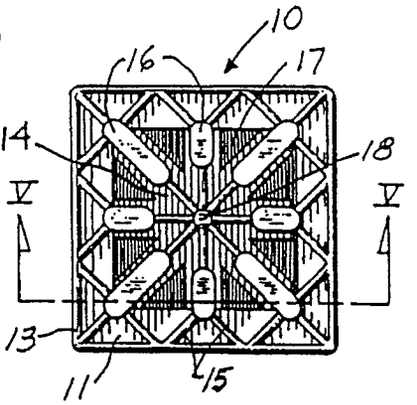


FIG. 3

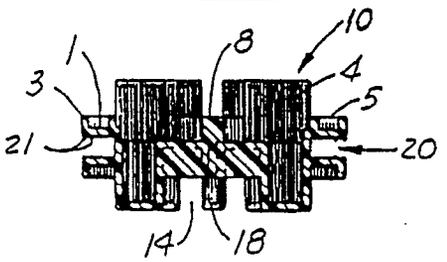


FIG. 4

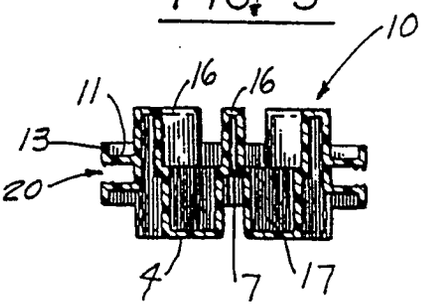


FIG. 5

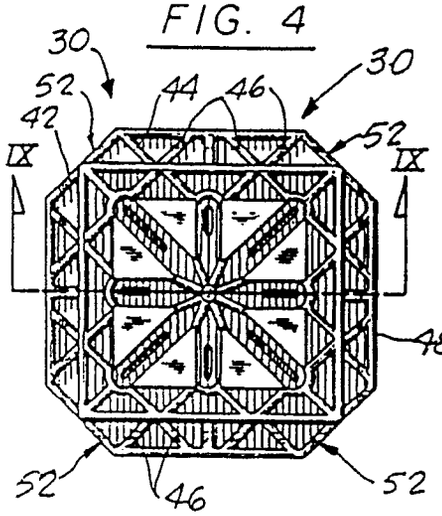


FIG. 6

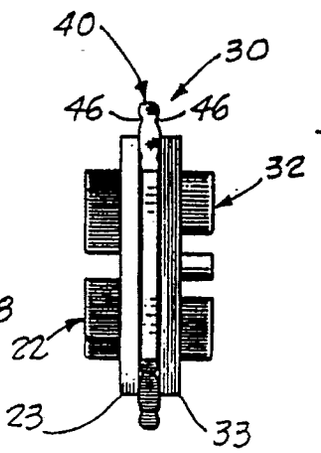


FIG. 7

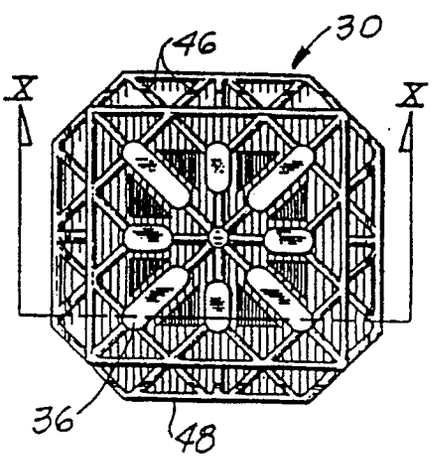


FIG. 8

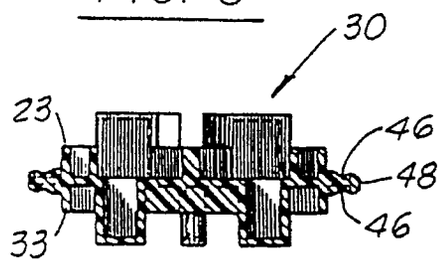


FIG. 9

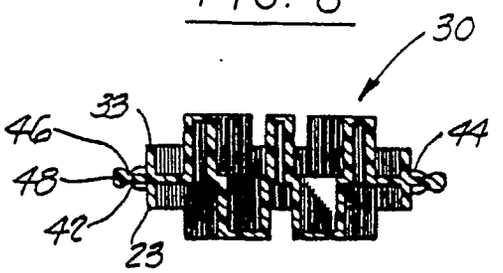


FIG. 10

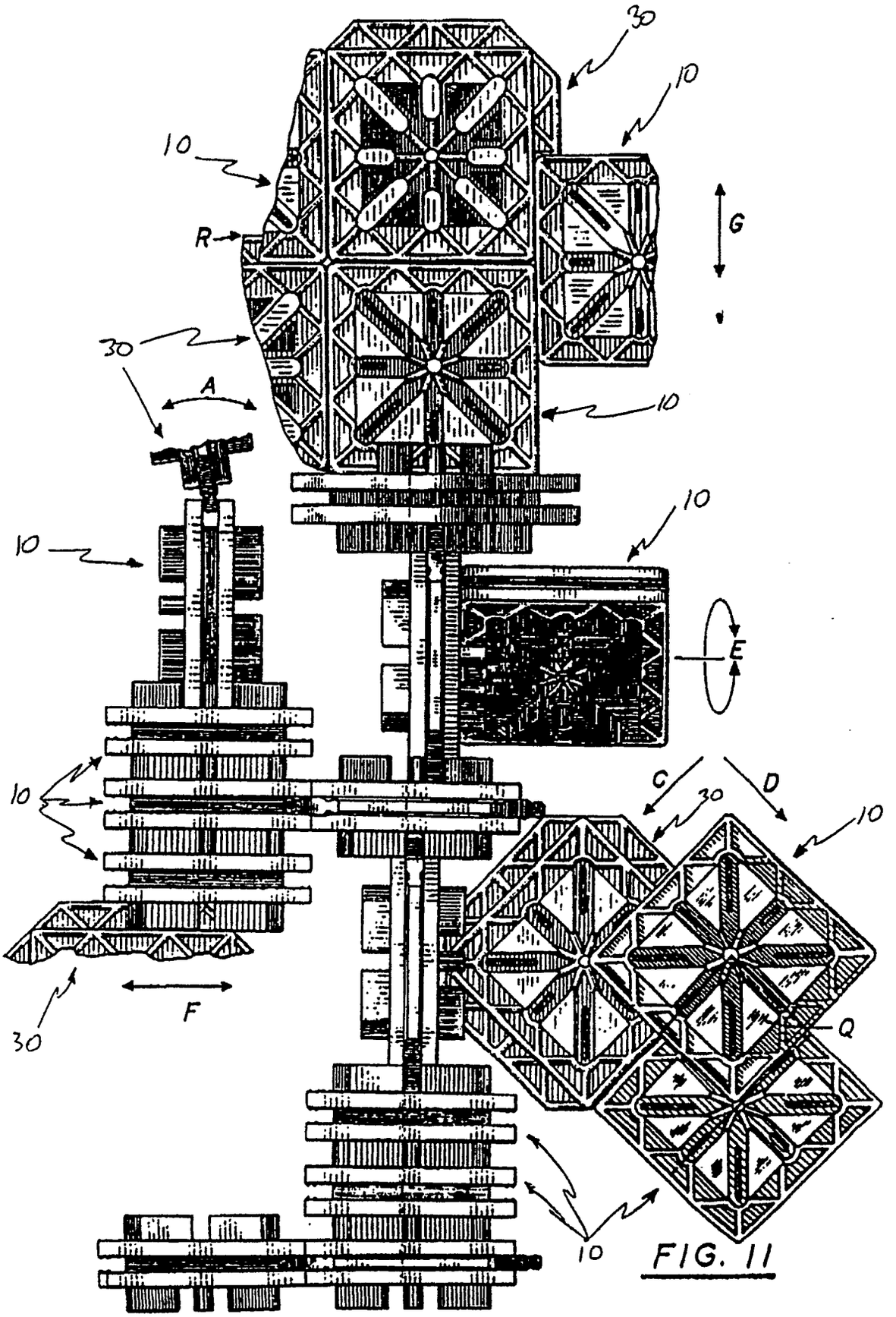


FIG. 11

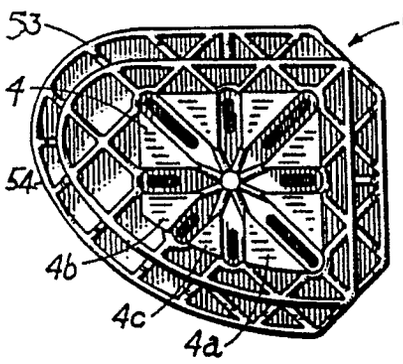


FIG. 12

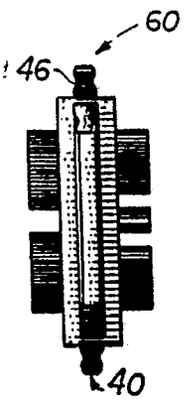


FIG. 13

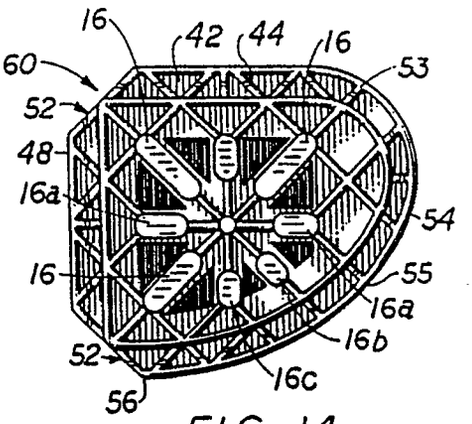


FIG. 14

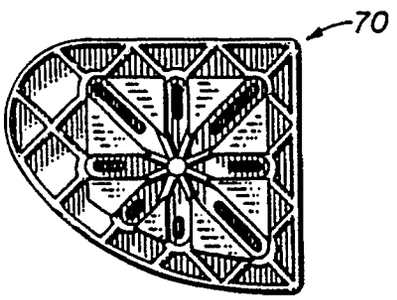


FIG. 15

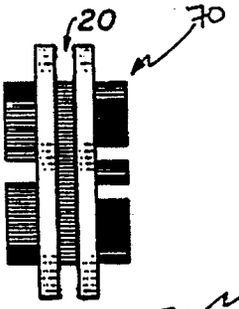


FIG. 16

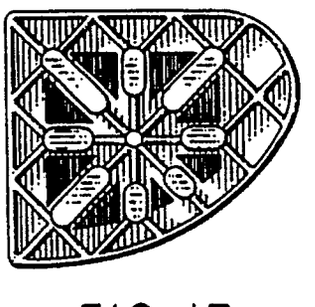


FIG. 17

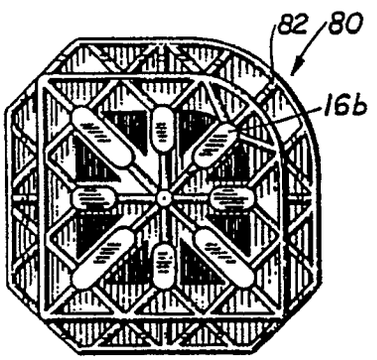


FIG. 18

FIG. 19

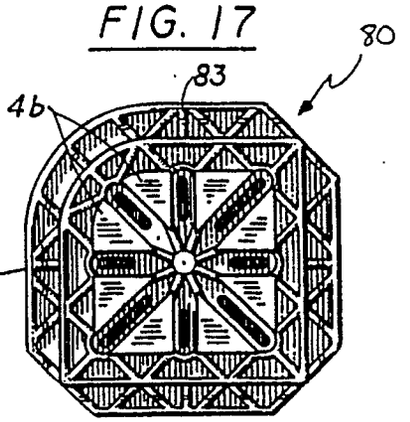


FIG. 20

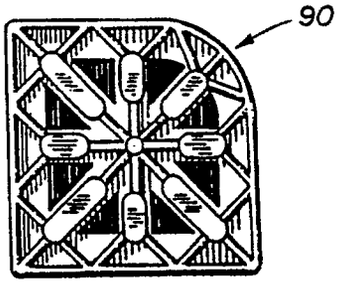


FIG. 21

FIG. 22

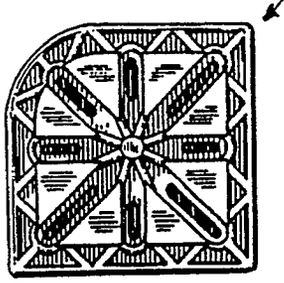


FIG. 23

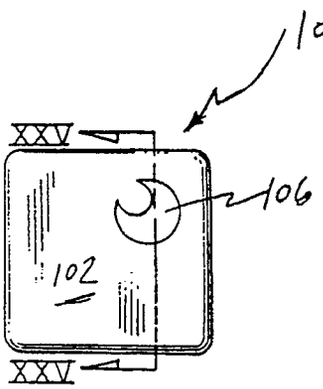


FIG. 24

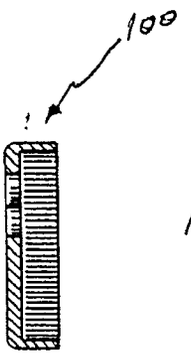


FIG. 25

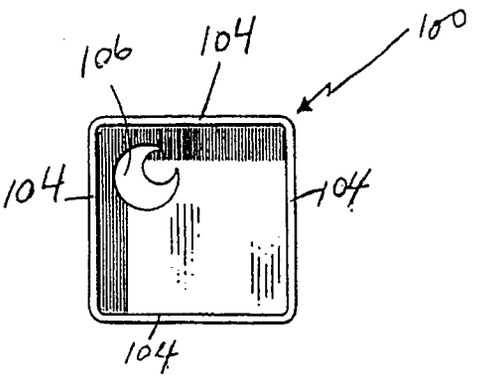


FIG. 26

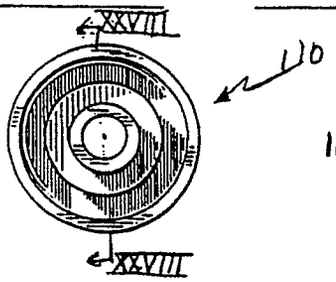


FIG. 27

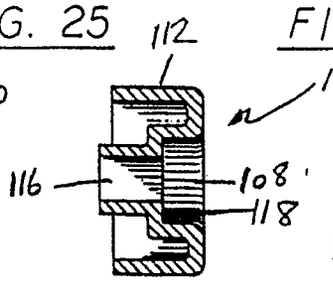


FIG. 28

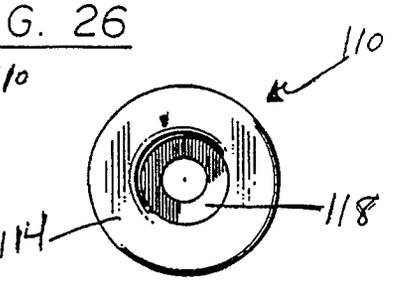


FIG. 29

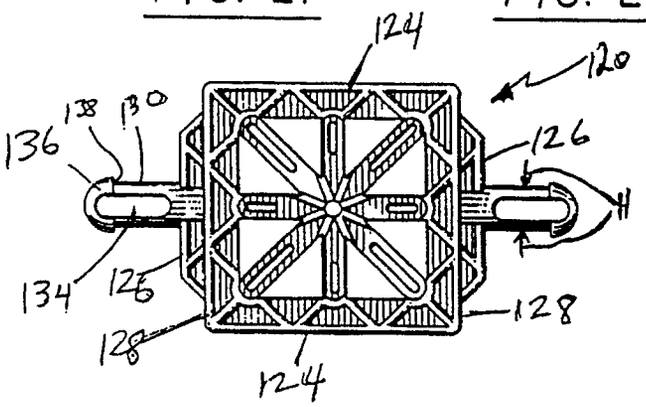


FIG. 30

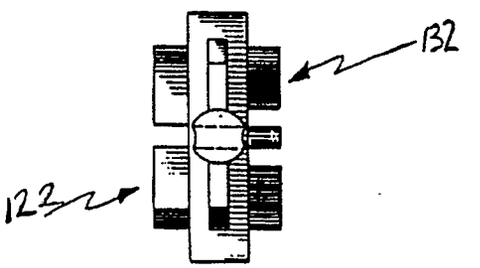


FIG. 31

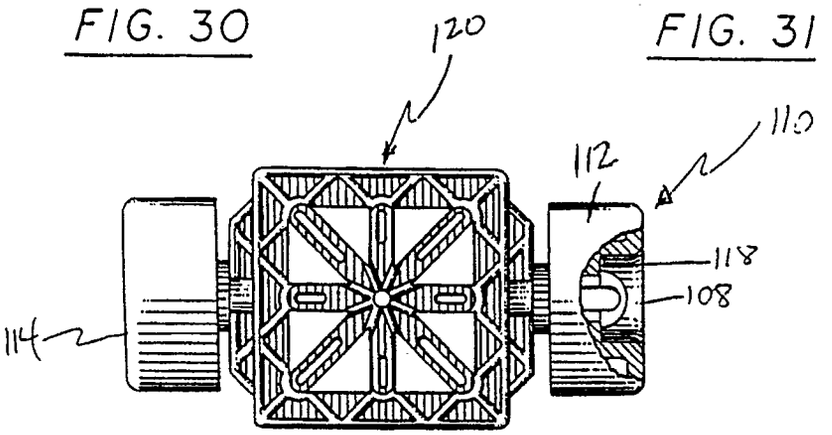


FIG. 32

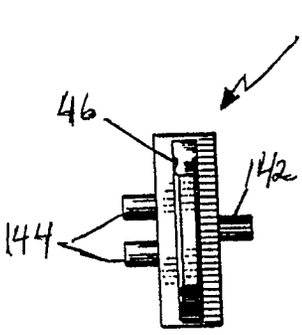


FIG 33

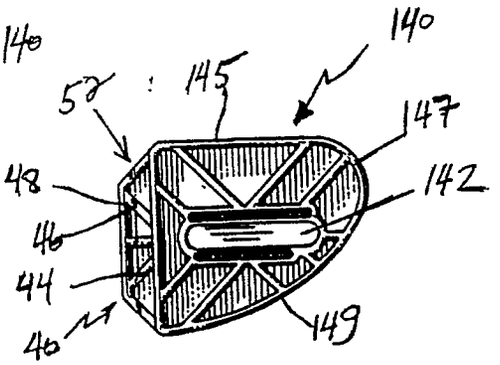


FIG. 34

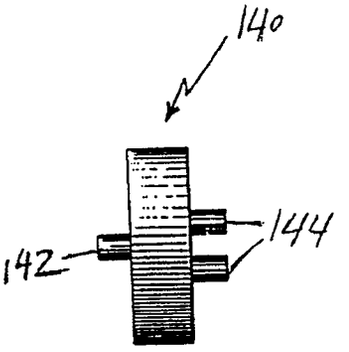


FIG. 35

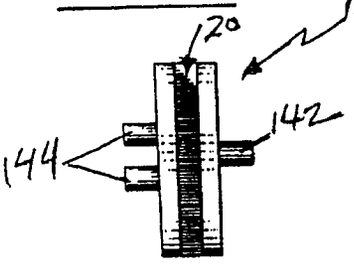


FIG. 36

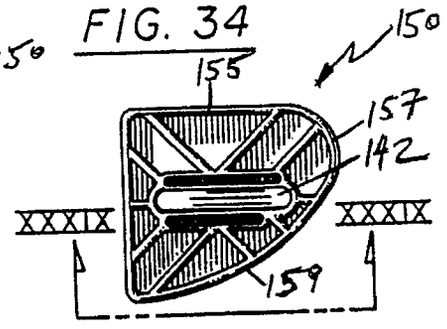


FIG. 37

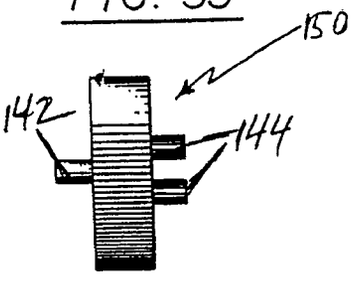


FIG. 38

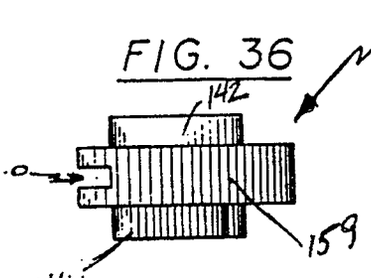


FIG. 39

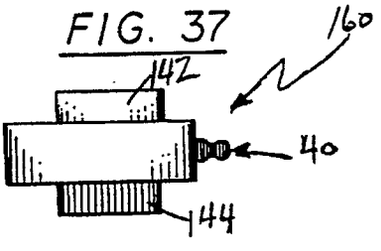
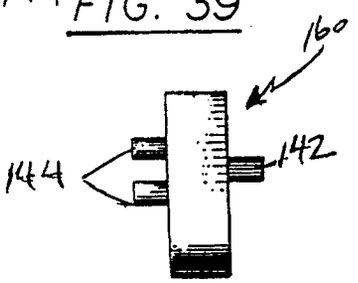


FIG. 40



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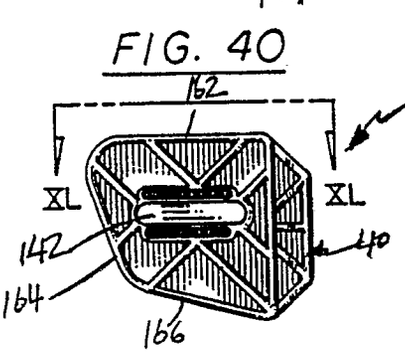

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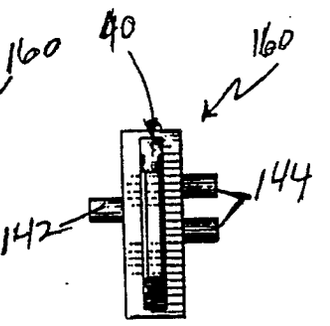

FIG. 43

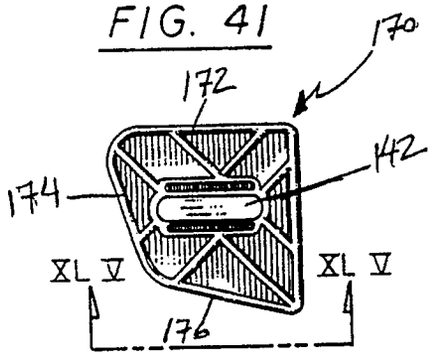

FIG. 44

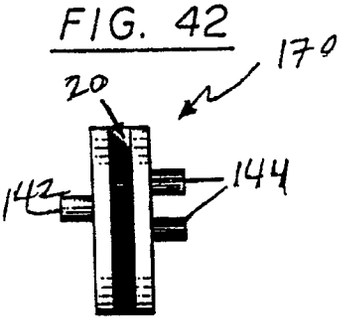

FIG. 45

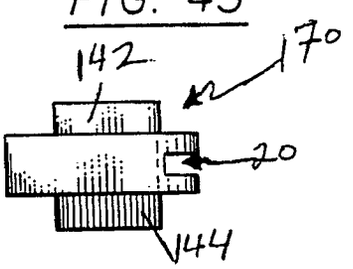

FIG. 46

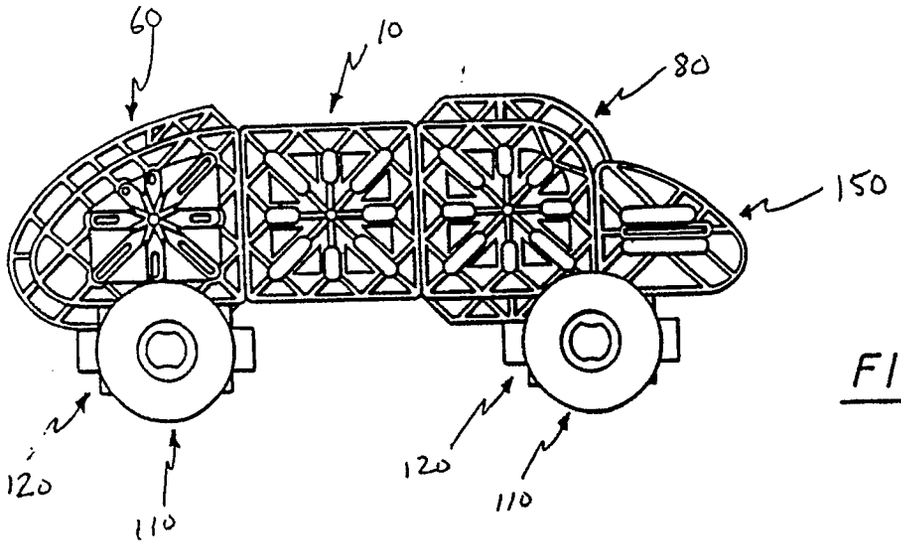
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FIG. 47

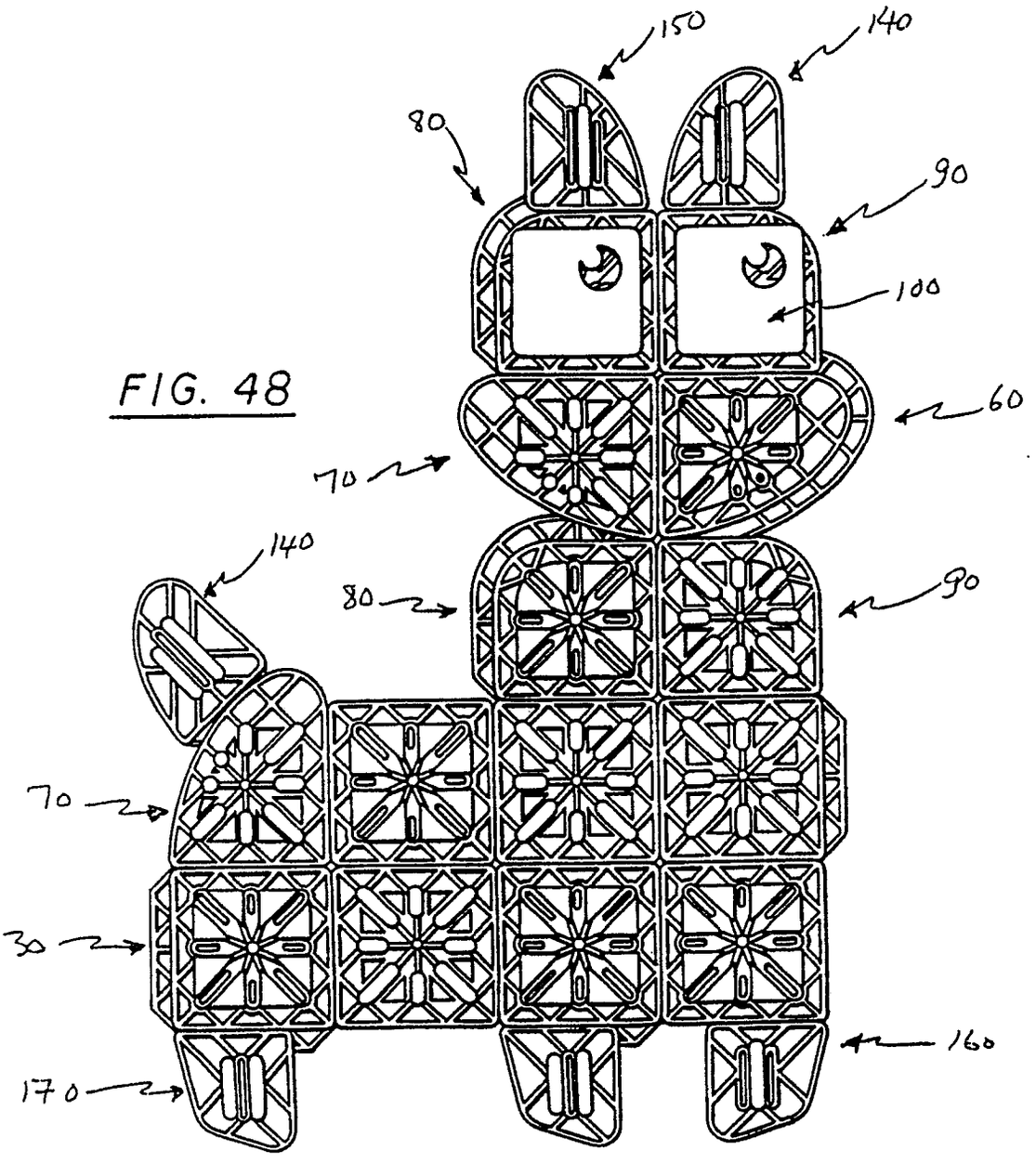
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FIG. 48

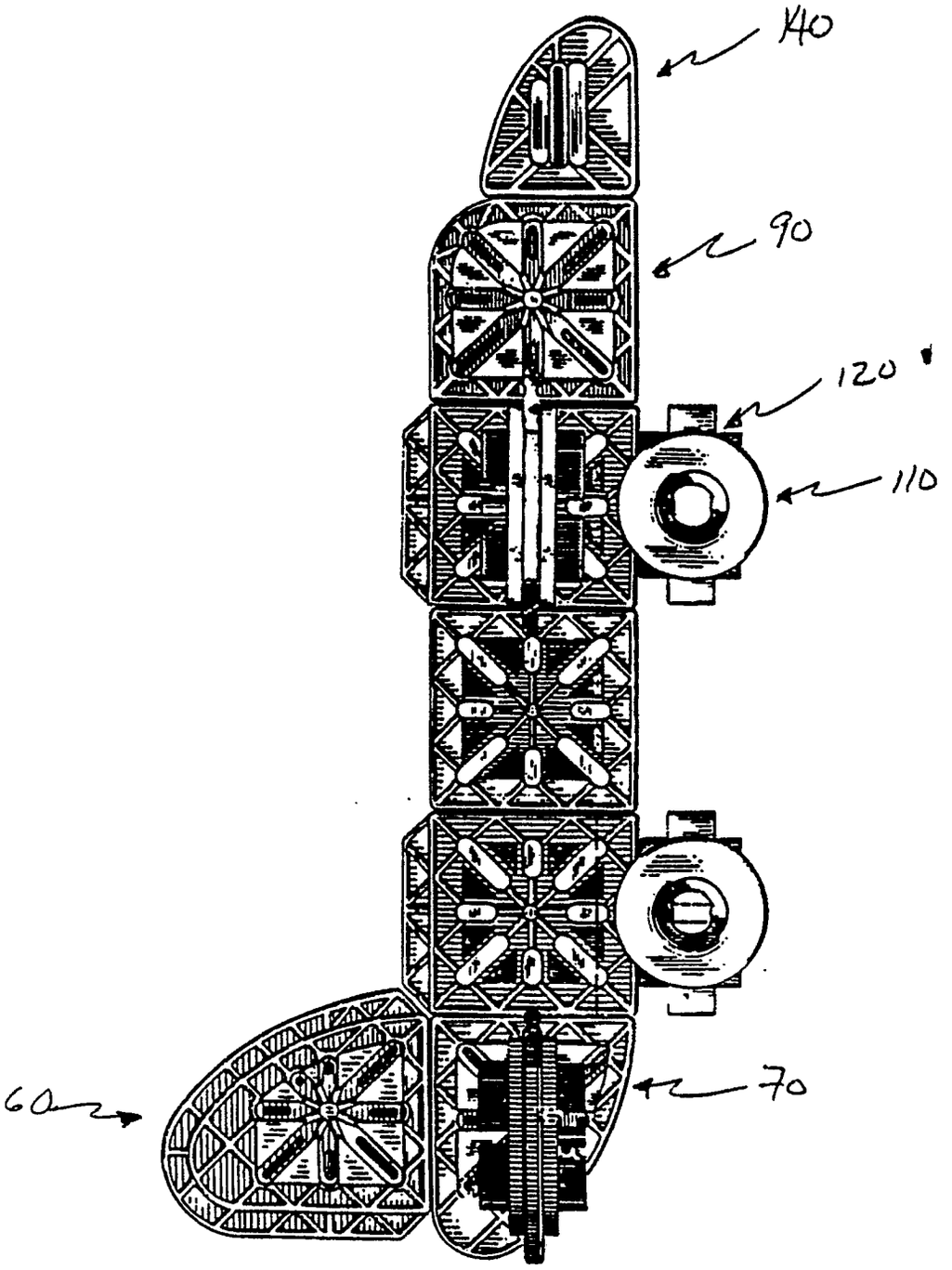

FIG. 49

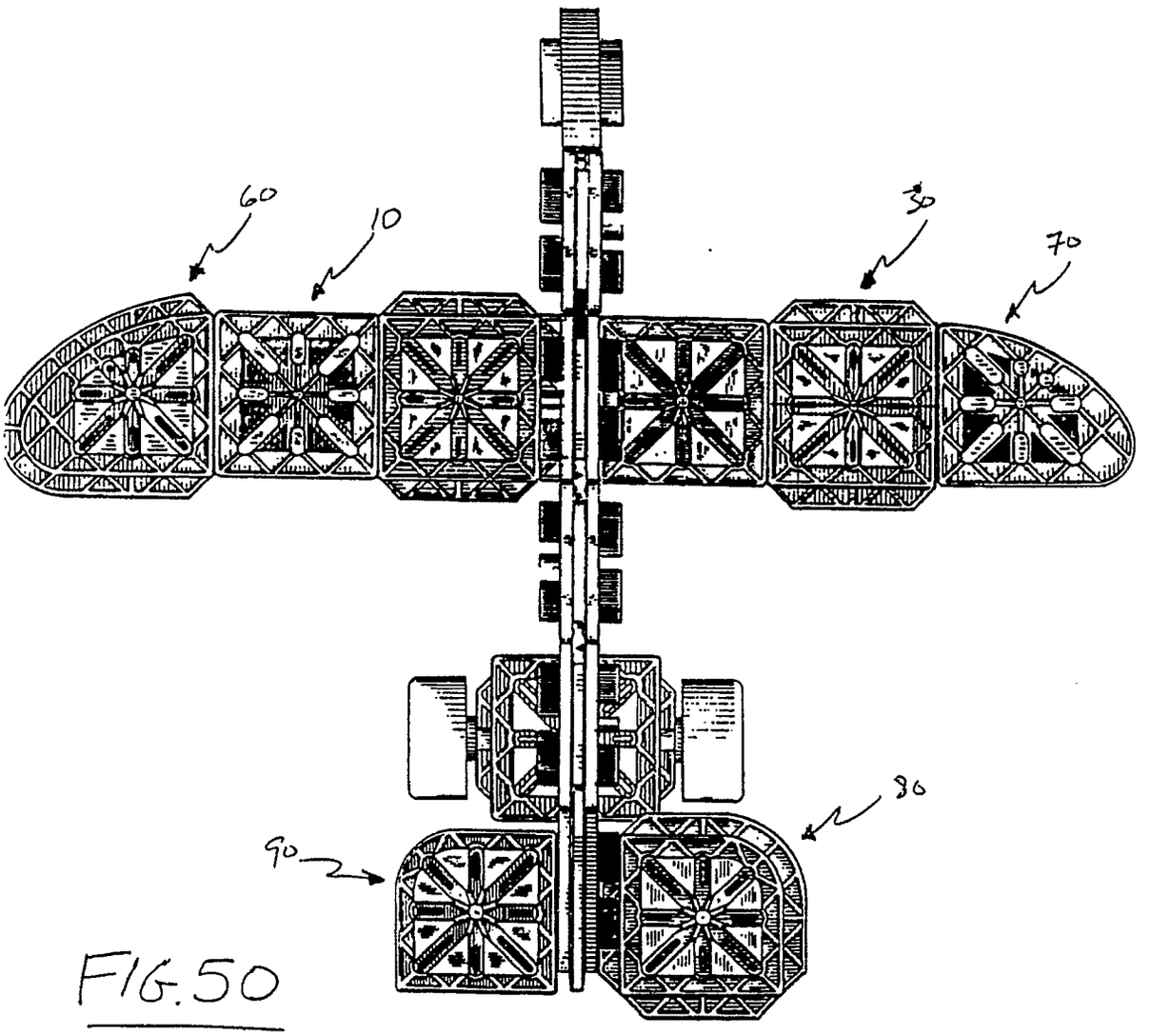

FIG.50

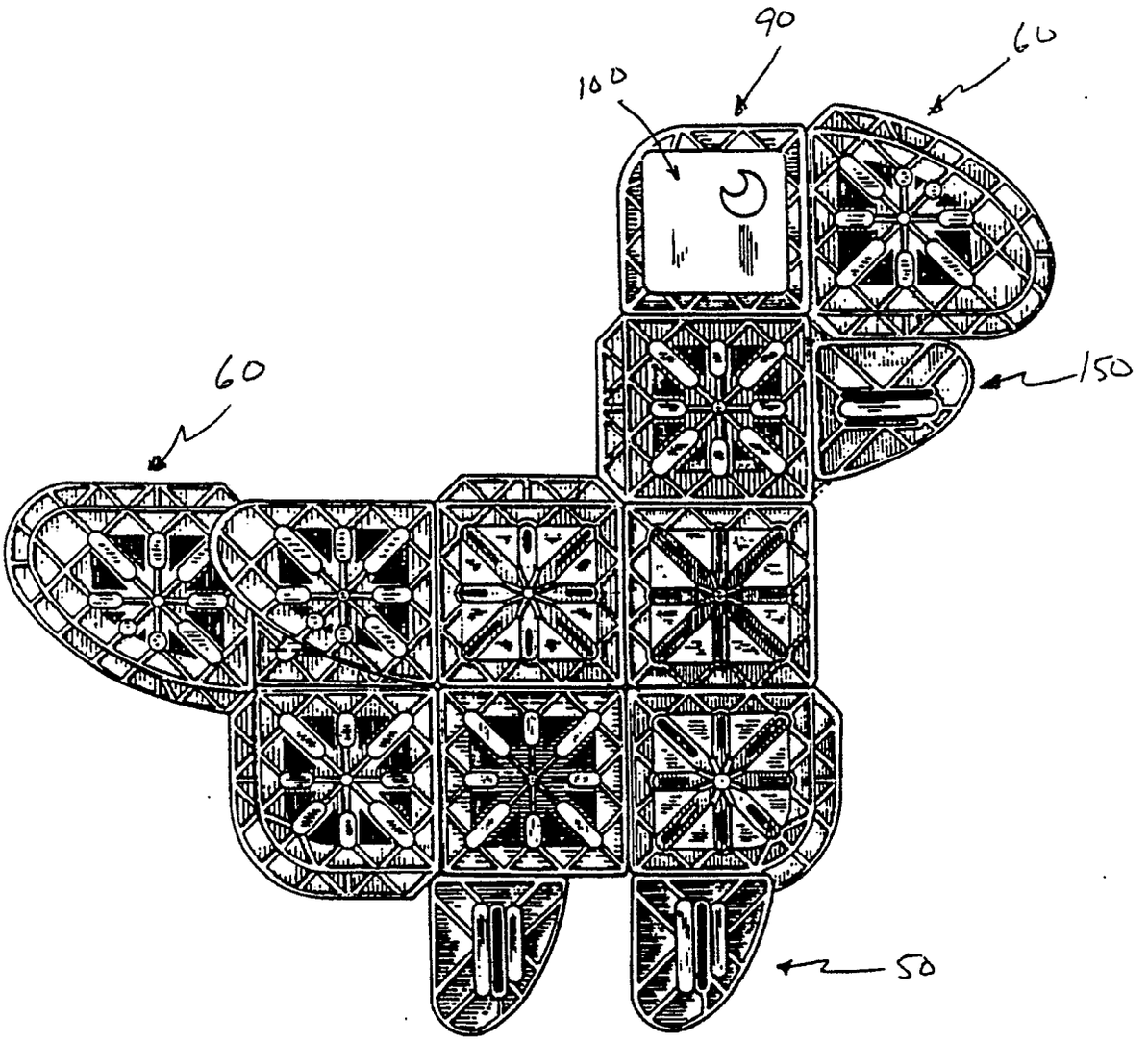

FIG. 51

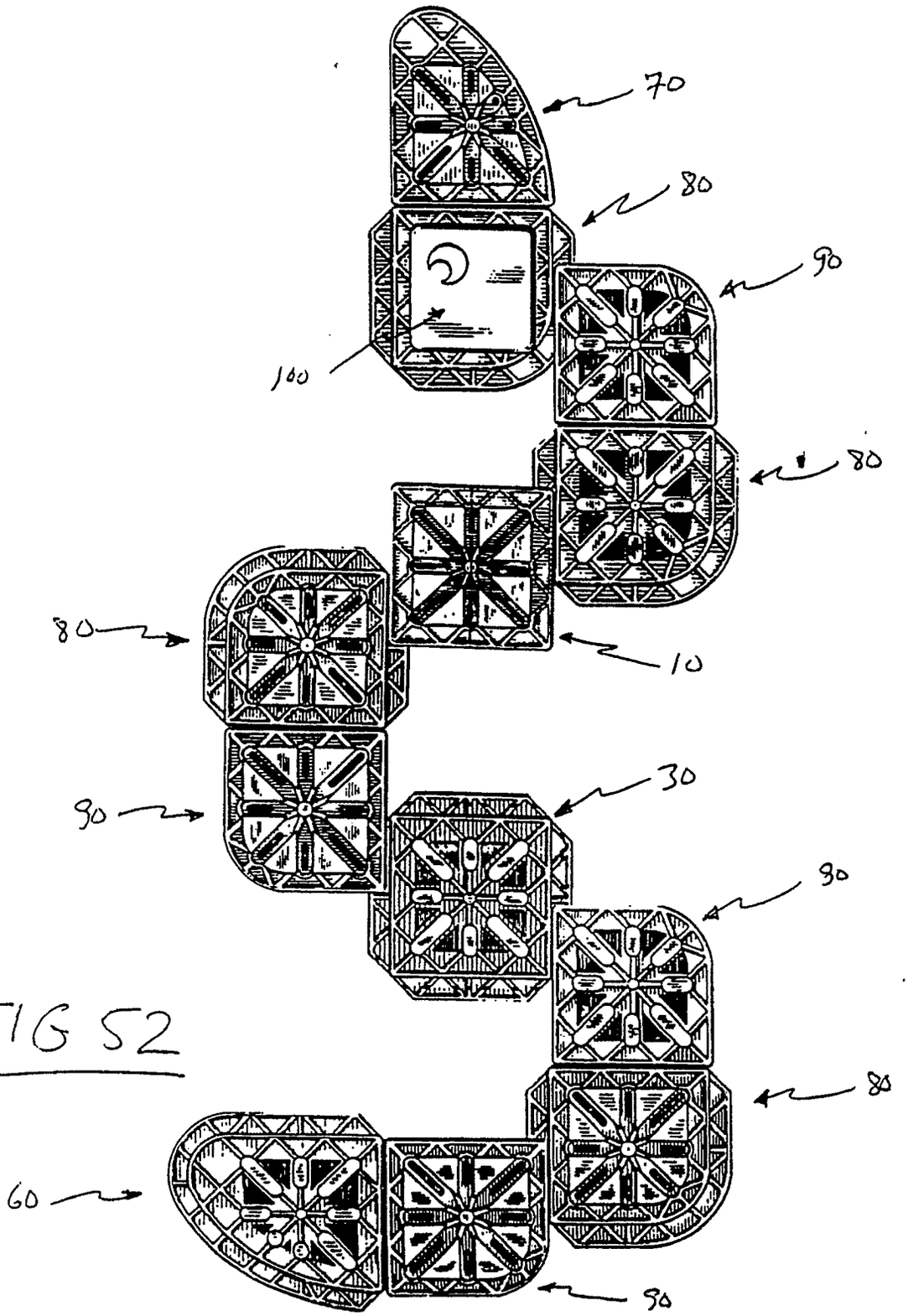

FIG 52

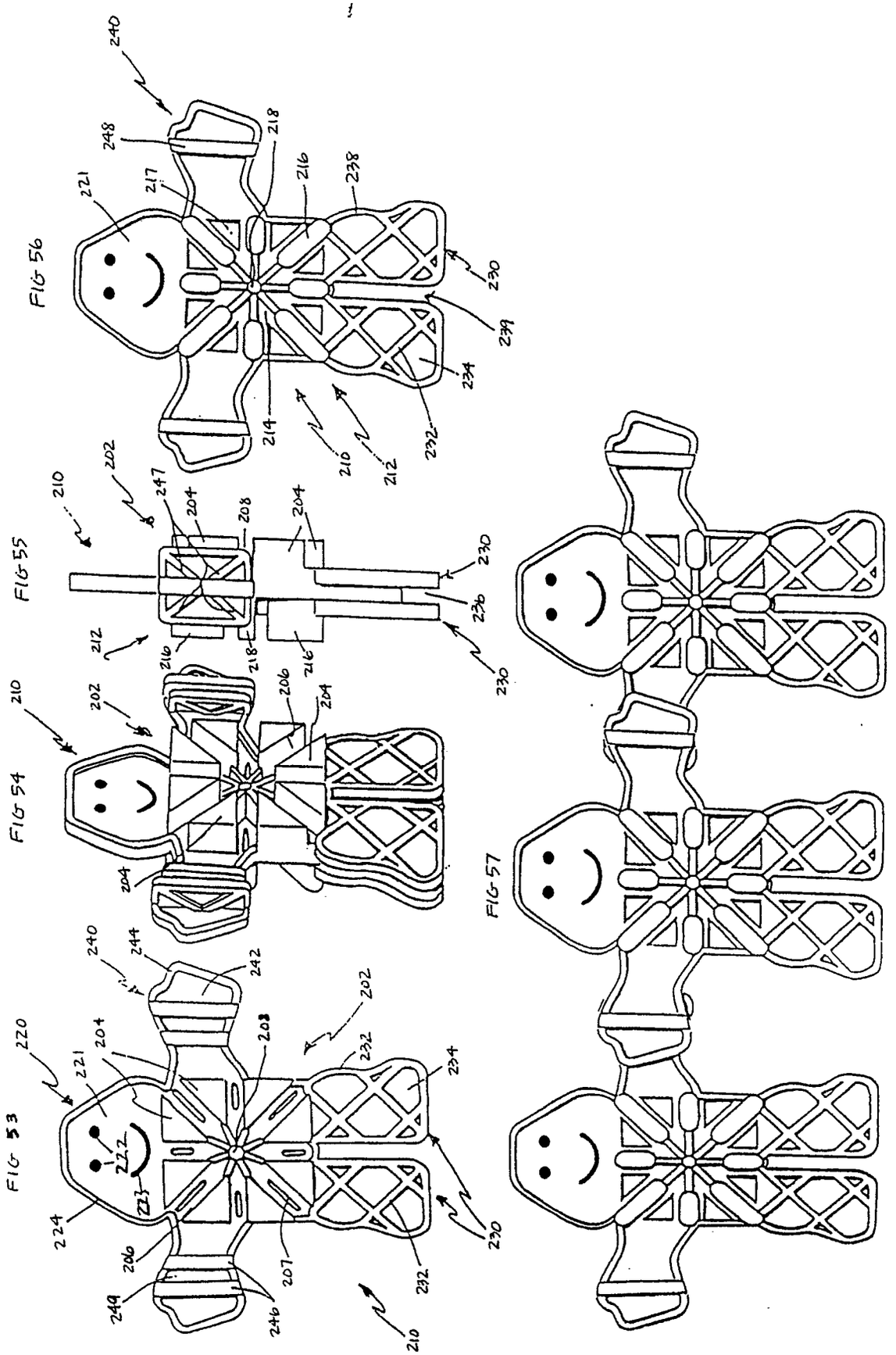
FIG 53
FIG 54
FIG 55
FIG 56
FIG 57

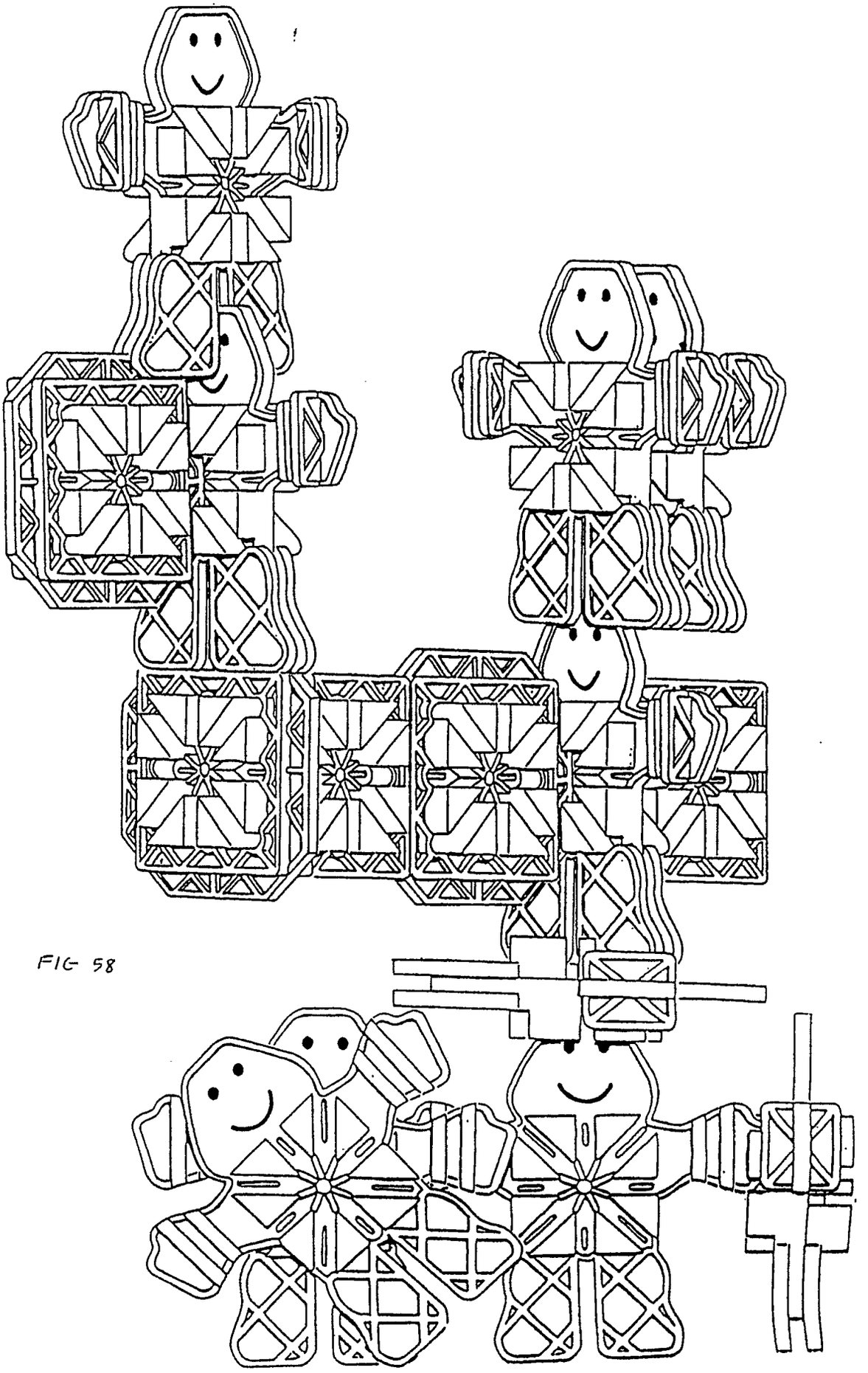

FIG 58

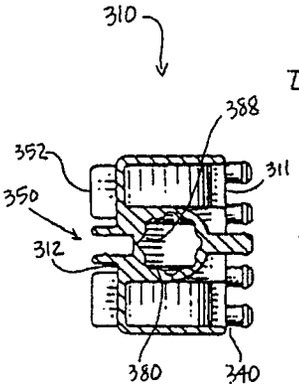

FIG 59

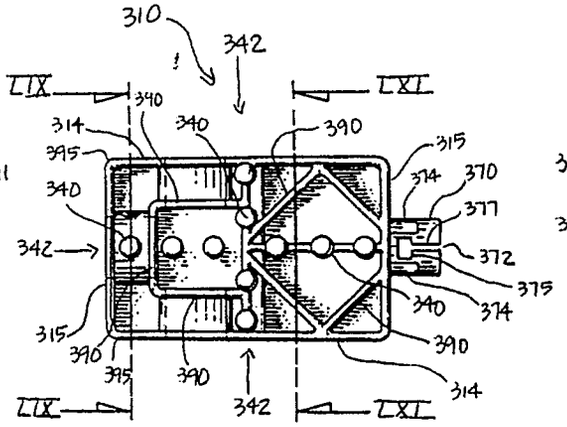

FIG 60

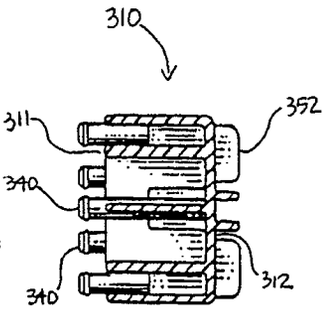

FIG 61

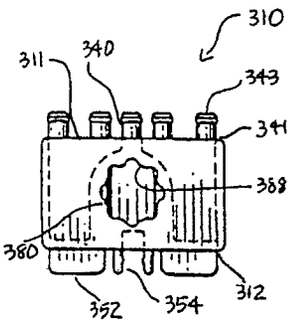

FIG 62

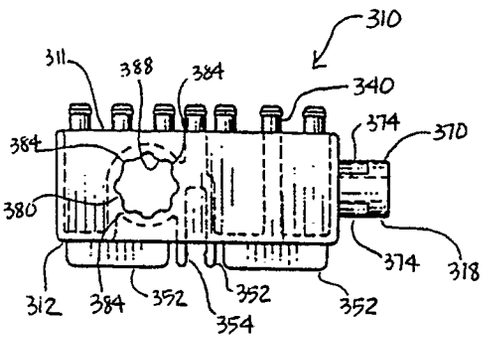

FIG 63

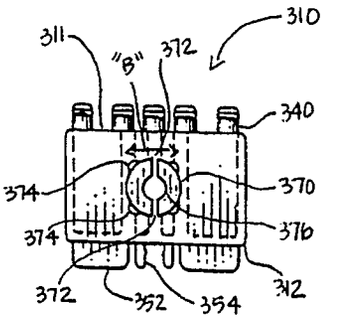

FIG 64

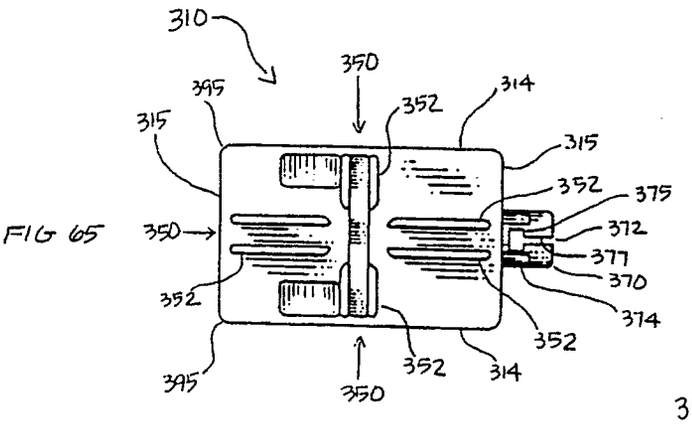

FIG 65

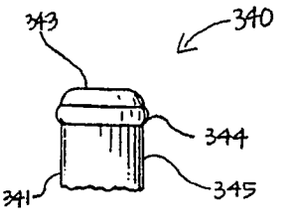

FIG 66

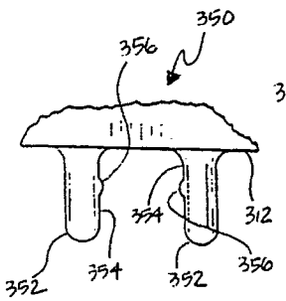

FIG 67

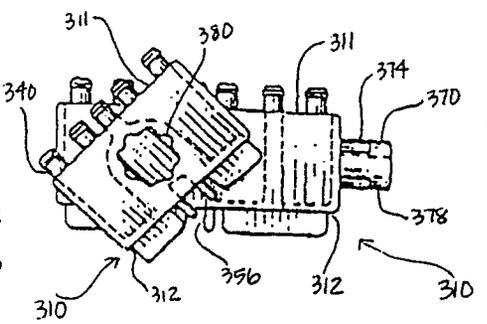

FIG 68

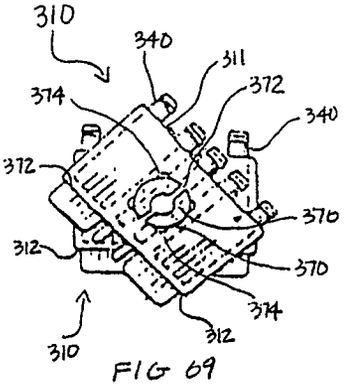

FIG 69

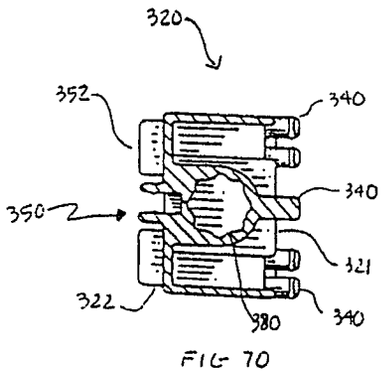

FIG 70

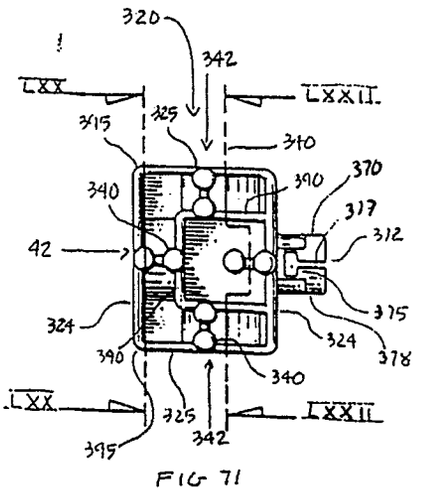

FIG 71

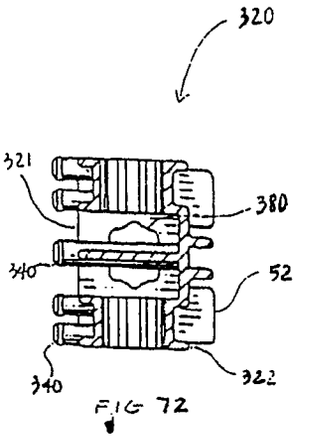

FIG 72

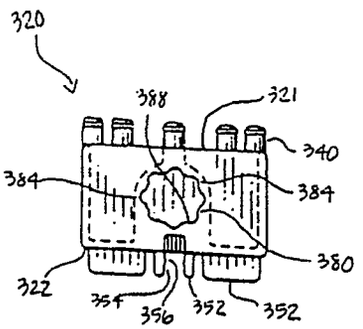

FIG 73

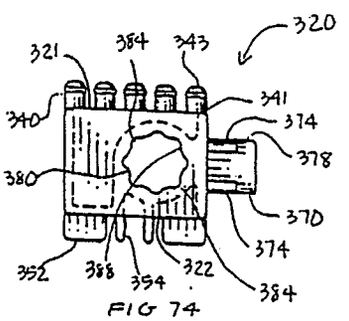

FIG 74

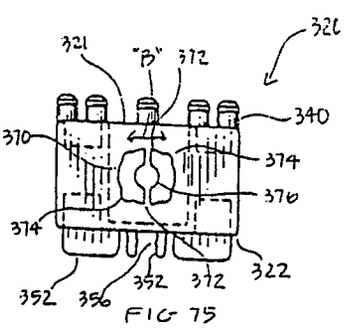

FIG 75

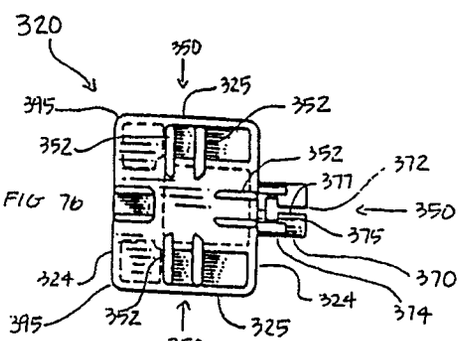

FIG 76

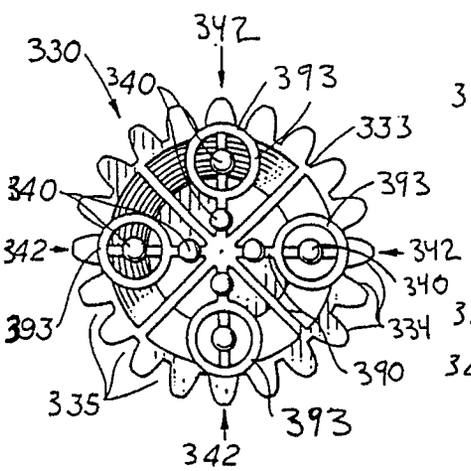

FIG. 77

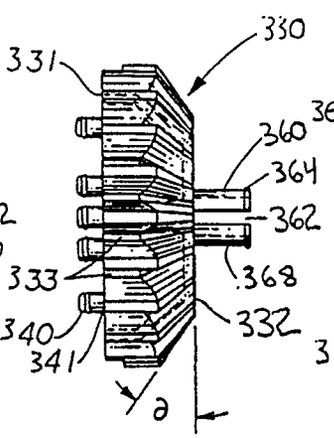

FIG. 78

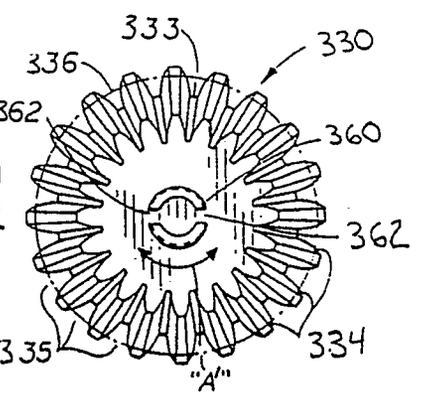

FIG. 79

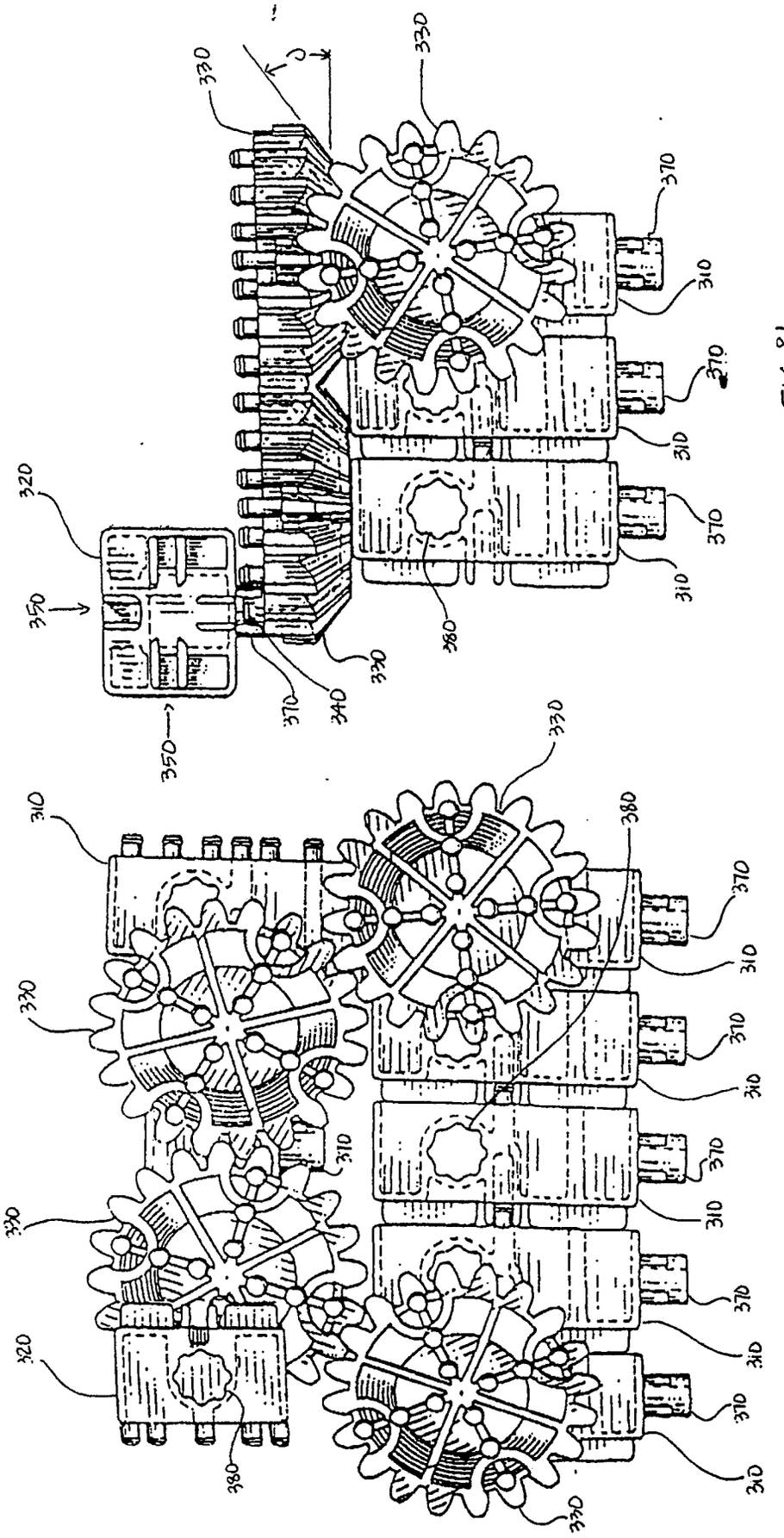
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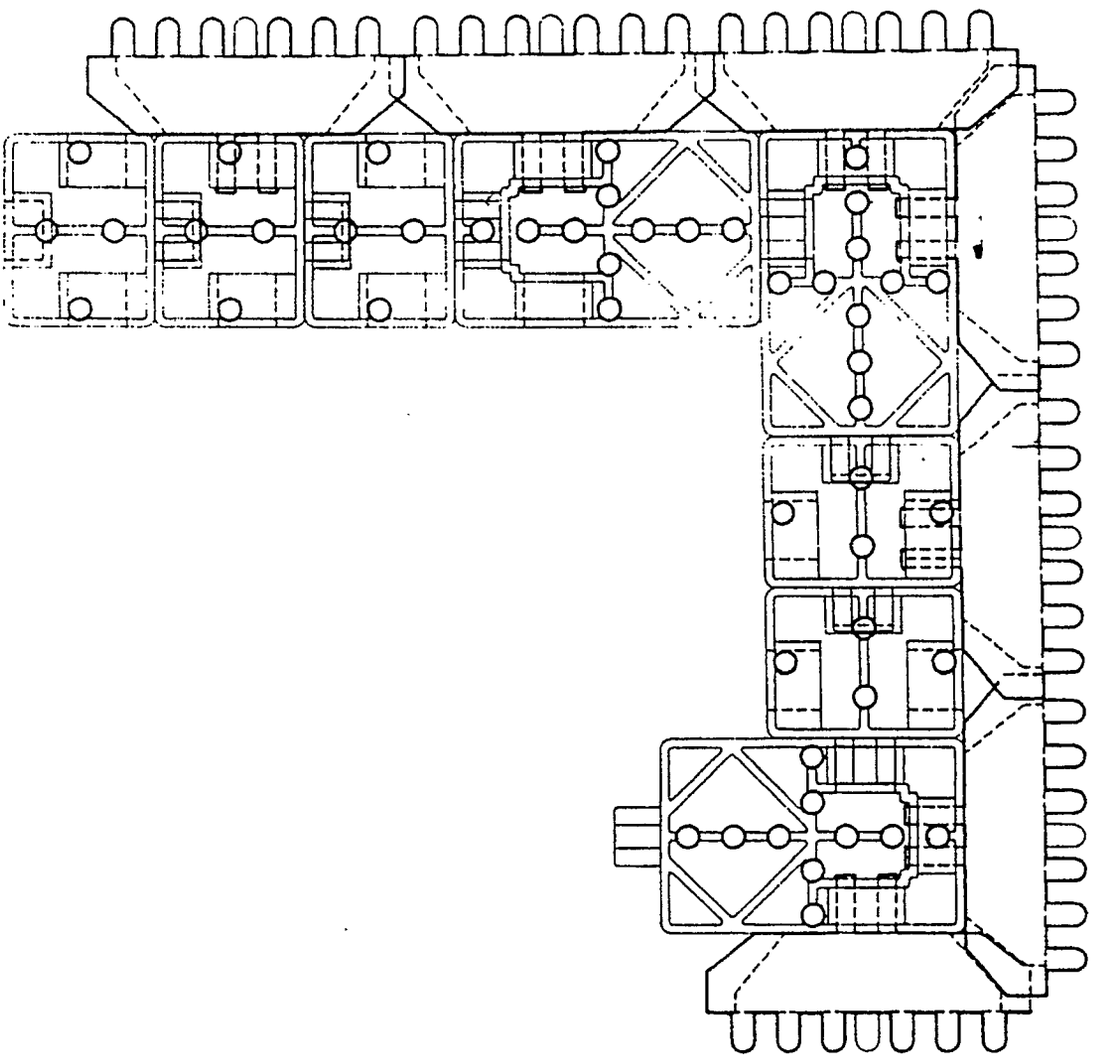
FIG 81

FIG 80

FIG 82



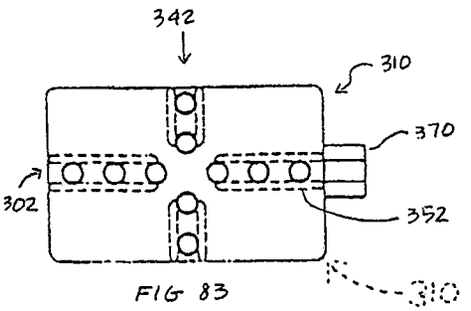


FIG 83

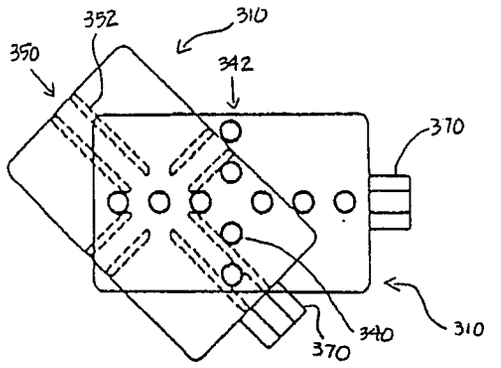


FIG 86

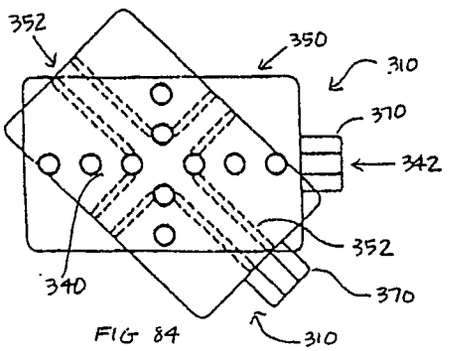


FIG 84

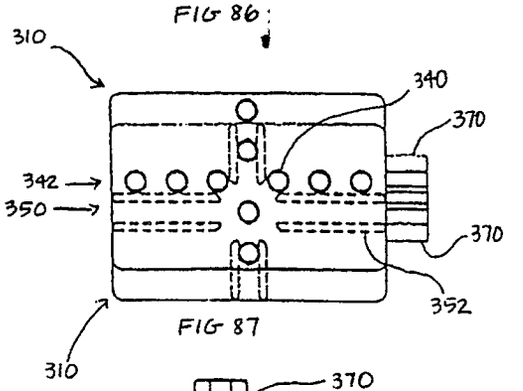


FIG 87

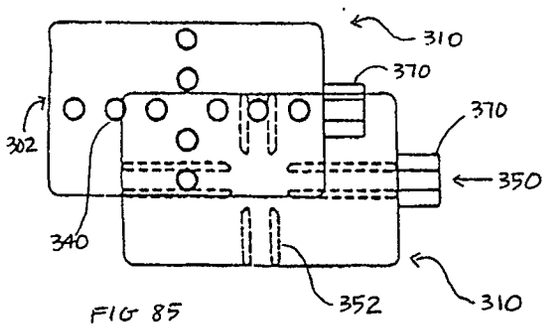


FIG 85

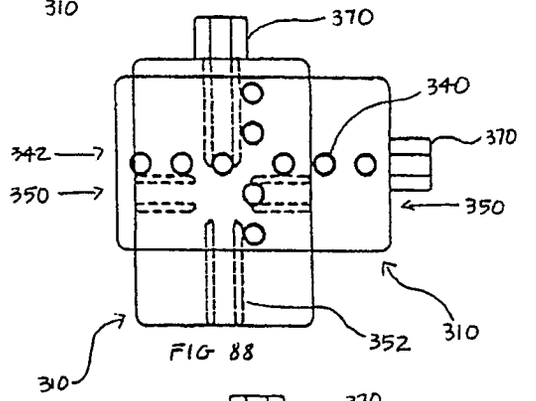


FIG 88

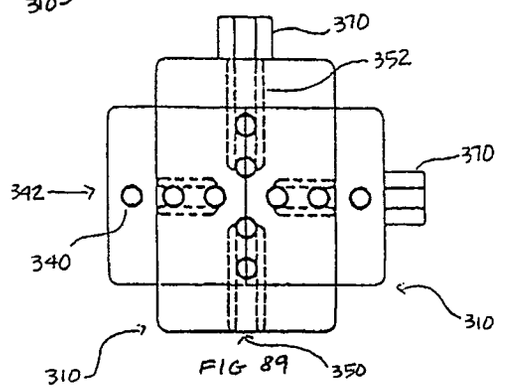


FIG 89

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EUROPEAN SEARCH REPORT

Application Number EP 90870179.0

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	US - A - 4 731 041 (ZIEGLER) * Fig. 1-10 * --	1,2,3, 6,7	A 63 H 33/08
D,A	US - A - 3 603 025 (HEUBL) * Fig. 1,2,7,8,11,12 * --	1,2,3, 6,7,9	
D,A	US - A - 4 792 319 (SVAGERKO) * Fig. 1-13; claim 9; abstract * --	1,2,3, 6,7,8	
A	US - A - 3 442 044 (QUERCETTI) * Fig. 1-15 * --	1,2,3, 6,7	
A	DE - A - 2 446 475 (CIOPTIA) * Fig. 1-8 * --	1,2,6, 7,8,9	
D,A	US - A - 3 496 670 (SLOOP) * Fig. 1-13 * --	1,3,7, 8	TECHNICAL FIELDS SEARCHED (Int. Cl.5) A 63 H 33/00
A	US - A - 3 461 601 (KRISTIANSEN) * Fig. 1-7 * --	7,10	
A	US - A - 3 513 587 (FISCHER) * Fig. 1-10 * --	7,10	
D,A	US - A - 4 789 369 (LYMAN) * Fig. 1-13 * --	4,5	
A	DE - B - 1 603 194 (ACH) * Fig. 1-7 *	4,5	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	20-12-1990	BRÄUER

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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90870179.0

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	US - A - 171 533 (SCHMETZER) * Fig. 1-5 *	4,5	
D,A	US - A - 3 867 784 (LANGE) * Fig. 1-12 *	1,2,3, 6	
A	GB - A - 1 585 436 (WEN-PIN) * Fig. 1-14 *	1,3,8	
D,A	US - A - 3 895 456 (FABRE) * Fig. 1,2,5 *	1,9	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)

The present search report has been drawn up for all claims

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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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