

March 2, 1971

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3,566,531

MATING BLOCKS HAVING BEADED STUDS AND RESILIENT SIDEWALLS

Filed Feb. 15, 1968

4 Sheets-Sheet 1

Fig. 1

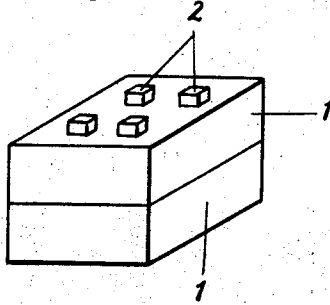


Fig. 3

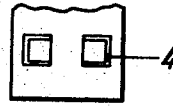


Fig. 2

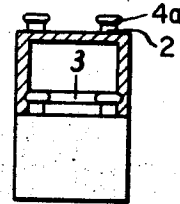


Fig. 4

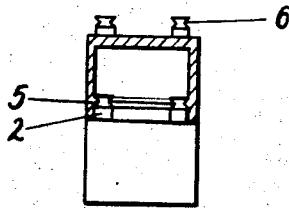


Fig. 5

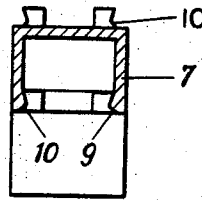


Fig. 6

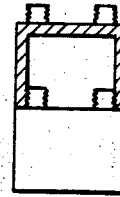


Fig. 7

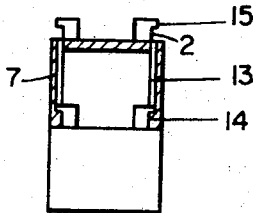


Fig. 8

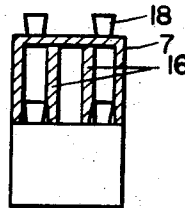


Fig. 9

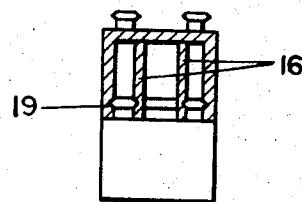


Fig. 11

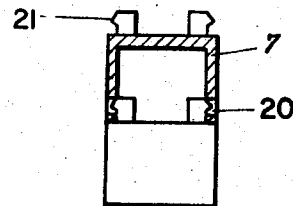
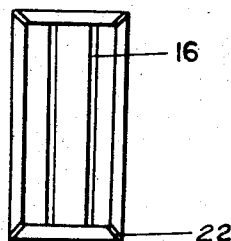


Fig. 10

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Fig. 13

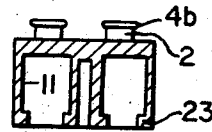
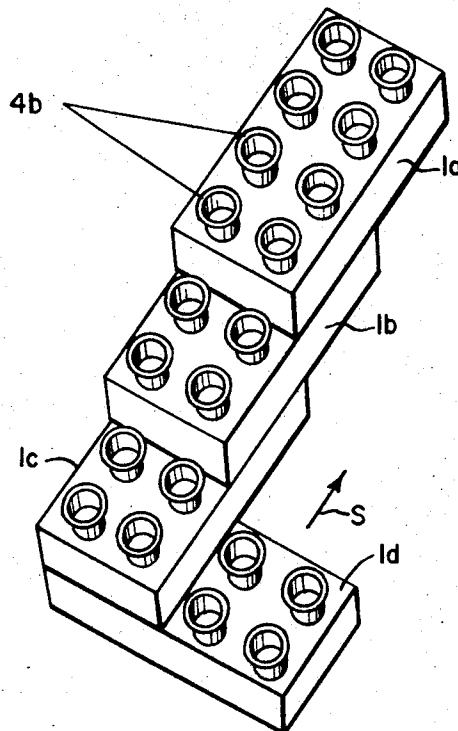


Fig. 12



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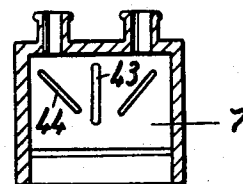
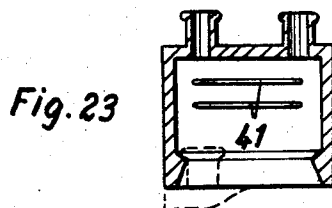
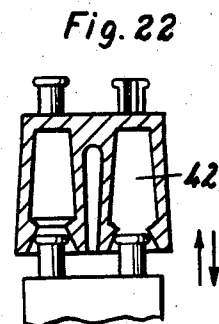
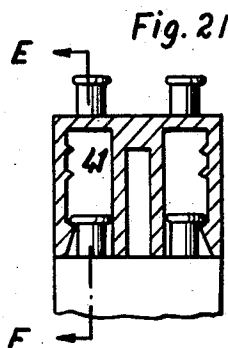
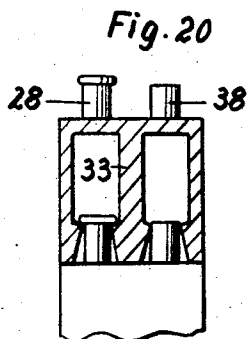
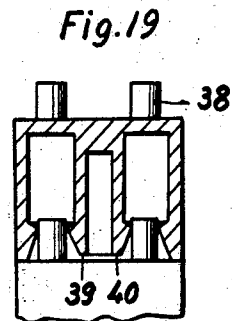
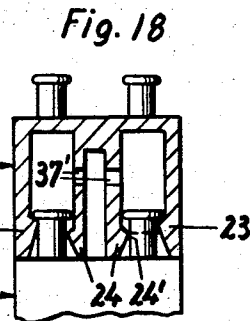
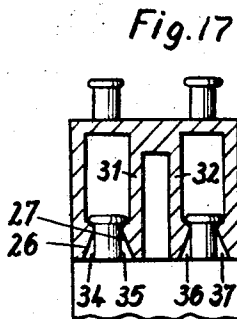
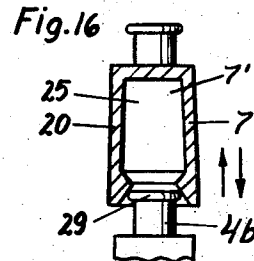
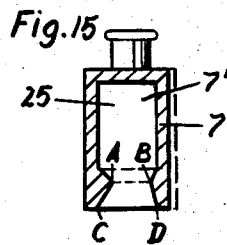
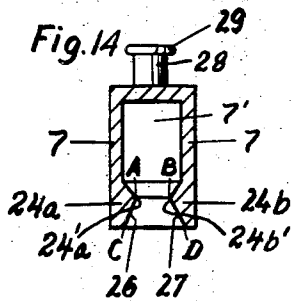
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Fig. 25

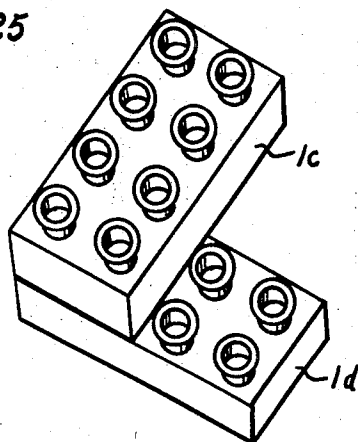
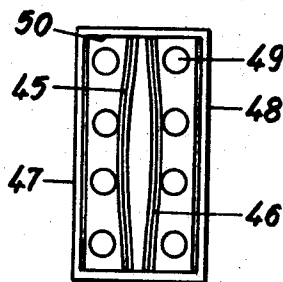
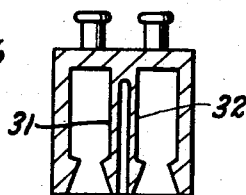


Fig. 27

Fig. 26



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MATING BLOCKS HAVING BEADED STUDS AND RESILIENT SIDEWALLS

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Continuation-in-part of applications Ser. No. 284,992, June 3, 1963, Ser. No. 404,009, Oct. 15, 1964, and Ser. No. 557,850, May 13, 1966. This application Feb. 15, 1968, Ser. No. 742,986

Claims priority, application Germany, June 9, 1962, P 12 02 694.7-15; Mar. 25, 1964, H 52,160

Int. Cl. A63h 33/08

U.S. Cl. 46-25

14 Claims

ABSTRACT OF THE DISCLOSURE

Hollow, box-like toy blocks open on the lower side and having studs on the upper side to mate with the open side. The studs may have beads and there are resilient side walls forming the opening, the edges of which may have notches to receive the beads. Sawtooth projections may be provided on said edges, to be cammed aside by the beaded studs. The blocks may have interior partition walls and different walls of a block may vary in flexibility. The studs may be hollow and the walls apertured to allow other elements to pass into the block interior.

This is a continuation-in-part of our copending applications Ser. No. 557,850, filed May 13, 1966, and Ser. No. 404,009, filed Oct. 15, 1964, both now abandoned, both of which applications were based upon and copending with our basic application Ser. No. 284,992, filed June 3, 1963, now abandoned.

The present invention relates to toy building elements of a hollow box-like shape, each of which is open at its lower side, while the wall opposite and parallel to this lower side is provided with several pairs of stud-like or similar outer locking projections which are adapted to be inserted into the open side of another building element and to be connected to suitable projections or recesses on the inner walls thereof. Each of these stud-like projections is oriented on the outer wall of the block so as to form one corner of a square defined by four adjacent projections.

In toy building elements of the above-mentioned type which were known prior to this invention a clamping effect between the adjacent building elements for connecting them to each other is attained by providing additional connecting elements in the form of so-called secondary studs as the inner side of the wall carrying the projecting outer studs, the so-called primary studs. These secondary studs extend through the inside of the hollow elements and are arranged and of a size so as to engage with and clamp by force fit the outer studs of an adjacent building element which are inserted into the first element.

These known toy building elements have the disadvantage that, even though they may at first be clamped well enough together to form a toy building or the like, the clamping action between the adjacent building elements decreases considerably with use and finally ceases entirely when they are frequently used. Furthermore, they have the disadvantage that the possibility of associating them with each other in different positions is limited since two building elements can be connected to each other only in a relatively small number of positions which depends upon the number of secondary studs provided. Thus, for example, two building elements can only be connected to each other in a manner so that the upper element will cover one quarter, one half, three quarters, or the entire lower element.

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It is an object of the present invention to provide hollow box-shaped toy building elements which overcome the above-mentioned disadvantages. This object is attained according to the invention by providing the inner sides of the vertical walls of each box-shaped element with groovelike or similar recesses or with riblike projections which extend substantially parallel to the wall carrying the projecting outer studs and serve as counterlocking means, which are operatively associated with the outer projecting connecting studs on another building element. These counterlocking means may be designed so as to extend either continuously or intermittently along the inside of the walls of each building element.

Another feature of the invention consists in increasing the locking effect between the adjacent building elements by providing the connecting studs of one element along their entire peripheral surface or at least a part thereof with lateral projections or recesses which correspond to the recesses or projections on the inner sides of the vertical walls of the adjacent element so that the projections on one element interengage with the recesses of the other element providing a snap-lock fit between elements. In addition, in order to provide such a connection, the vertical side walls of the elements are made to be sufficiently flexible to allow the corresponding projections to slide around one another during connection.

Another feature of the invention consists in providing the insides of each building element with one or two partitions which extend parallel to each other and parallel to the longitudinal walls of the element and terminate flush with the edge of the open side thereof. Each of these partitions is located at such a distance from the adjacent longitudinal wall that the projecting studs of another building element will fit tightly between them. However, these partitions are also preferably provided with groove-like recesses or riblike projections in accordance with those in or on the longitudinal walls of the building elements. In addition, these partitions are also made to be flexible and are spaced from each other sufficiently to allow projections thereon to slide around projections on the studs during engagement.

Further embodiments of the present invention serve to improve the building elements as above described so as to have a still better interlocking effect, to be more easily manipulated, and also to be more easily manufactured. For attaining this object, the present invention provides that the vertical walls of the hollow boxlike body of each building element are made of a resilient construction and that the locking projections at the inside of each element have such a saw-tooth shape that, when on two opposite walls which are provided with such saw teeth and imaginary straight line is drawn which extends at right angles to vertical walls, passes through the tip of one saw tooth, and extends up to the opposite tooth, this line forms the shorter upper base line of a trapezoid, the longer base line of which is determined by a straight line which is drawn from the inner edge of one vertical wall to the inner edge of the opposite vertical wall and the lateral lines of which are determined by the positions of the flanks of the saw teeth in a plane including these lines.

If at least the stem parts of the connecting studs are cylindrical, a triangular space will then remain between the tooth flank and a vertical plane tangential to the peripheral surface of the stem and coextensive with the point of contact between the stem and tooth flank, whereas if the connecting studs have a square cross section, the tooth flank and the outer wall surface of the connecting stud will enclose a triangularly-shaped area.

The above-mentioned as well as additional features and advantages of the present invention will become more clearly apparent from the following detailed descrip-

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tion thereof which is to be read with reference to the accompanying drawings, in which.

FIG. 1 shows a perspective view of two interconnected building elements according to the invention;

FIG. 2 shows a front view of two interconnected building elements, the upper one of which is shown in cross section;

FIG. 3 shows a top plan view of a part of a building element;

FIGS. 4 to 10 show views similar to FIG. 2 of building elements which are provided with connecting parts according to different modifications of the invention;

FIG. 11 shows a bottom plan view of a building element which is provided with partitions;

FIG. 12 shows a perspective view of four interconnected building elements which are provided with cylindrical connection studs;

FIG. 13 shows a cross section of one of the building elements according to FIG. 12;

FIGS. 14 to 16 show cross sections of three building elements which do not have any additional partitions and have either only one connecting stud or several connecting studs behind each other;

FIGS. 17 to 22 show cross sections of building elements according to different modifications of the invention and provided with additional partitions;

FIG. 23 shows a cross section which is taken along the line E-F of FIG. 21;

FIG. 24 shows a view similar to FIG. 23, in which, however, the reinforcing ribs are differently arranged;

FIG. 25 shows a perspective view of two building elements which are attached to each other;

FIG. 26 shows a cross section of a building element according to FIG. 25; while

FIG. 27 shows a bottom view of a building element.

As illustrated in FIG. 1, the toy building elements 1 according to the invention are provided with square-shaped connecting studs generally indicated by numeral 2 which are disposed in pairs adjacent to each other so that each is associated with one corner of a square formed by four studs. Instead of being made of square cross section, these connecting studs 2 may, of course, also be of a round configuration, as seen in FIG. 12, or oval, or similar shape. Of course, it is also within the contemplation that larger blocks containing more than four studs in alignment in pairs be provided, as also seen in FIG. 12.

According to the first embodiment of the invention, as shown in FIG. 2, the vertical inner walls of each building element are provided with a continuous horizontal groove 3 into which the outer edges of the ribs 4a on the connecting studs 2 may engage. These ribs 4a may extend entirely around the end of each stud 2 or only along at least the outer edge thereof. In FIG. 3, these ribs 4 are provided on the three outer sides of each square connecting stud, but not on the inner side facing the adjacent stud. In FIG. 12, the rib 4b is provided continuously around the periphery of each round connecting stud.

The grooves 3 in the vertical walls of each building element which extend along all of these walls to form one closed rectangular groove may also be intermittent; these grooves need have only a certain length and be spaced at a suitable distance from each other to provide for engagement with the studs of another block. It is, however, of advantage, to make these grooves continuous since adjacent transversely interconnected building elements may then be shifted longitudinally relative to each other in a continuous manner across the length of the blocks. The arrangement of the grooves 3 and ribs 4 may, of course, also be reversed as shown in FIG. 4, in which the vertical walls of the building element are provided with inwardly projecting ribs 5 which engage into the grooves 6 in the ends of studs 2.

In the modification according to FIG. 5, walls 7 are slightly tapered as indicated generally by numeral 8 so that the inner distance between the walls decreases slight-

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ly in the upward direction. The lower inner edges 9 of these walls are also slightly beveled. The connecting studs are then provided with recesses 10 of a corresponding shape.

FIG. 6 shows another modification in which the inner walls of the hollow building element are knurled or serrated as indicated by numeral 11 and the connecting studs are shaped accordingly as indicated by numeral 12.

In FIG. 7, the upper parts of the vertical walls of the building element are provided with recesses 13 each of which terminates near the lower end of the wall so that a projection 14 remains thereon. The connecting studs 2 likewise have lateral projections 15 which engage behind the projections 14 when the two superimposed building elements are connected to each other.

FIGS. 8 and 9 illustrate two further modifications of the invention, in which each building element is provided with a pair of partitions 16 which extend parallel to the longitudinal walls and terminate flush with the edges of the open side of the building element. These two partitions are spaced at a distance from each other suitable to allow the partitions to flex sufficiently to permit the inner sides of the connecting studs 2 to tightly engage with them and thus be clamped thereon. In the embodiment of FIG. 8 the partitions 16 may be smooth. Also, the open ends of the partitions 16 and of the longitudinal walls may be slightly bevelled as indicated by numeral 17 to facilitate the insertion of the connecting studs 2. Likewise, the connecting studs 2 may be bevelled, as indicated by numeral 18. In the embodiment of FIG. 9 the surfaces of the partitions 16 which face the adjacent outer wall of the building element may be provided with grooves as indicated by numeral 19 so as to provide a means for engaging connecting studs similar to those shown in FIG. 2.

According to a further modification as illustrated in FIG. 10, walls 7 of each building element may also be provided with continuous slots 20 for receiving the projections 21 on the connecting studs.

As indicated above, past experience has shown that known building elements of the type disclosed herein tend to lose their capacity to interconnect tightly with continued usage and this is due to the provision of the relatively small connecting projections as flexible members, i.e., either the so-called primary studs or secondary studs with the result that these flexible members eventually fatigue or break off altogether. In order to avoid this situation the connecting studs provided in accordance with the invention are inflexible due to their size and geometrical configuration and the vertical side walls are made flexible to allow the parts of relatively equal dimension to interengage. Thus, as a result of the large surface area of the flexible side walls as compared to the projecting studs, these walls may be flexed or distorted repeatedly over a long period of use without signs of fatigue or destruction.

In order to provide for the desired flexibility and economy of manufacture the invention proposes the manufacture of the disclosed building elements of an organic plastic material in their entirety, for example, polystyrol or polyethylene. With such material the blocks can be produced inexpensively in many different sizes, for example, by injection molding.

In order to additionally increase the resilience of the hollow building elements, which may be desired, for example, if they are to be provided with relatively rigid walls only slightly more flexible than the strong relatively inflexible locking projections thereon or with relatively deep grooves in these walls for receiving the locking projections of the connecting studs or if the locking projections on the connecting studs are relatively thick, one or another or all corners between the side walls of each building element may be provided with thin slots 22 as shown in FIG. 11.

FIG. 12 shows another modification of the invention in which the connecting studs 2 are of a tubular cylindrical

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shape and provided on their upper ends with projecting locking rims 4b. In FIG. 13, portions of the inner and adjacent surfaces of the corresponding vertical walls and partitions are removed to provide projections 23 which will clampingly engage with the connecting studs of FIG. 12 when inserted.

Thus, by providing clamping means continuously along the surfaces of the vertical walls and partitions of the building element construction in accordance with the instant invention, the number of positions of transverse association between two elements is unrestricted. For example, in FIG. 12, element 26 may be shifted with respect to element 25 in the direction of arrow S to an infinite number of positions between the extreme end positions, providing for a far greater flexibility in use.

As illustrated in FIGS. 14 to 16, which disclose an improved embodiment of the invention, each of the two outer walls 7 of the building elements is provided on its inner side with a saw-tooth-shaped projection 24a or 24b. These projections may also extend along the transverse walls 7, as shown in FIGS. 14 and 16 and as indicated in dotted lines in FIG. 15.

Assuming that in FIG. 14 a straight line is drawn which extends vertically to the plane of the vertical walls and through the tip 24a or 24b of one tooth and up to the opposite tooth, the straight line A-B will be formed. If another straight line is drawn from the inner edge of one wall 7 to the inner edge of opposite wall 7, the distance C-D will be determined. The line A-B then forms the smaller upper base line of a trapezoid, while the straight line C-D forms the longer lower base line thereof. The side lines of this trapezoid are formed by the tooth flanks 26 and 27. The connecting studs 28 which project from the upper wall of the building element are provided at their upper ends with beads 29 of a width in accordance with the width between the walls 7.

The building element as illustrated in FIG. 15 is provided with saw-tooth-shaped projections which are unsymmetrical insofar as the vertical wall 7 has a more projecting tooth than the opposite vertical wall 7. If desired, the two vertical walls may also differ from each other, as indicated in FIG. 15 in dotted lines.

FIG. 16 shows a building element in the condition when it is just being connected to or separated from another building element of the same type. It is evident that under the action of the bead 29 on the connecting stud 28, the two resilient walls 7 will yield at both times resiliently in lateral directions and that, when the two building elements are either in the interconnected position or separated from each other, the resilient walls 7 will again be in their original straight position.

According to the further modifications of the invention as shown in FIGS. 17 to 22, each building element 30 is provided either with only one pair of connecting studs or with several pairs behind each other. Furthermore, each building element 30 is provided either with two partitions 31 and 32 or with only one partition 33. The building element according to FIG. 17 is of a symmetrical shape and when two of these elements are in the interconnected position, areas 36 and 37 will remain between the outer surfaces 34 and 35 of the connecting studs and tooth flanks 26 and 27. The two partitions 31 and 32 may be formed in each building element either by providing a central recess when the element is being molded or by cutting a slot into the central wall after the element has been molded. In the building element according to FIG. 18, the saw-tooth-shaped projections 24a and 24b are offset relative to each other in the vertical direction. Also in this case a trapezoidal surface is formed if the straight line for the smaller base line is drawn through the tip 24b' of the tooth of the shorter vertical height. The partitions are provided with two apertures 37' which may be desirable especially if the connecting studs are made of a tubular shape and connecting wires for illuminating or other purposes are to be passed

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through one or both of these studs and then through these apertures.

The building element according to FIG. 19 corresponds to that according to FIG. 17 with the exception of the connecting studs 38 which are fully cylindrical, and of the end surfaces 39 and 40 of the partitions which are located slightly above the base line.

The building element as illustrated in FIG. 20 is provided with two different connecting studs, the stud 28 at the left being of the type as shown in FIG. 1 and the stud 38 at the right being of the type as shown in FIG. 19. This building element is also provided with only one partition 33 which has more or less pronounced saw-tooth-shaped projections and may be either of a symmetrical or unsymmetrical shape including the connecting teeth. As shown particularly at the left part of FIG. 20, these teeth may also be very pointed or extend at an acute angle.

FIG. 21 shows a further modification in which the two partitions of the building element have smooth surfaces and the outer walls are reinforced by longitudinal ribs 41.

FIG. 22 illustrates in principle the manner in which the vertical walls of a building element are temporarily deformed when the connecting studs of another building element are either being inserted into or pulled out of first element. This drawing further illustrates one of the connecting studs as being tubular. The right half of the building element is also shown as having a transverse wall 42 without any connecting tooth at the right size.

FIG. 23 shows a vertical section of the building element according to FIG. 21 which is provided with longitudinal ribs 41, while FIG. 24 shows a similar view of another building element which is provided with a vertical rib 43 and oblique ribs 44 on each of the vertical walls 7. Such reinforcing ribs may be of considerable importance in view of the properties of the material employed and especially in view of its shrinkage.

If the vertical walls and the partitions have different spring values, for example, by making them of different thicknesses, by providing one or the other with reinforcements, or by other means, it is possible to vary the strength of the interlocking action and also the forces which are necessary for connecting the building elements to each other and for separating them from each other.

FIG. 25 shows two interconnected building elements each of which has eight hollow cylindrical connecting studs. The lower building element is attached to the upper so as to extend at a right angle thereto, and it is slidable in the longitudinal direction thereof from one end position to the other in the same manner as illustrated in FIG. 12.

FIG. 26 shows a vertical section of a building element according to claim 25, in which the partitions are considerably thinner and therefore more resilient than the outer walls.

FIG. 27 finally shows a bottom view of a building element according to a further modification of the invention, in which the partitions 45 and 46 are slightly curved from their center toward their outer ends relative to the outer walls 47 and 48. For the purpose of illustration, this curvature has been overemphasized in the drawing. The holes 49 indicate bores which extend through the upper wall and also through the connecting studs of the building element, while the numeral 50 indicates one of the vertical reinforcing ribs.

It is evident from the drawings that each building element may be provided with only one locking recess in one side and only one stud or a row of studs behind each other at the other side or with two or more such locking recesses in one side and two or more studs or two or more rows of studs at the other side.

Although our invention has been illustrated and described with reference to the preferred embodiments thereof, we wish to have it understood that it is in no way

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limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

We claim:

1. A toy building element of a hollow box-like shape having an open side extending in a horizontal plane, a first wall opposite and parallel to said plane, stud-like connecting members projecting at right angles from the outer side of said wall, a pair of opposite lateral walls substantially parallel to each other and secured to each other at least by said first wall and extending substantially at right angles thereto and being resiliently flexible toward their free ends at said open side, relatively more rigid end walls secured to said first wall and said lateral walls and extending at right angles thereto, locking means on said lateral walls and said connecting members for connecting two said elements, said locking means including a laterally projecting bead circumferentially disposed on the free end of at least one of said stud-like connecting members and saw-tooth-shaped projections, at least some of said projections begin on the inner sides of said lateral walls near said open side adapted to receive between them at least said one connecting member of a similar toy building element, said projecting bead on said one connecting member adapted to force adjacent ones of said projections of said first toy building element outwardly when inserted between them and, when said one connecting member is fully inserted into said first building element, said bead being adapted to snap behind said adjacent projections of said other building element, the portion of said one connecting member below said bead having generally a thickness at least equal to the distance between the tips of said adjacent projections.

2. A toy building element as defined in claim 1, wherein said projections have a shape determined by a trapezoid having a shorter upper base line extending at right angles to said lateral walls and passing through the tip of one projection and up to the opposite projection, the longer base line of said trapezoid extending from the inner edge of one of said lateral walls to the inner edge of the other lateral wall, and the lateral lines of said trapezoid forming the tooth flanks of said projections.

3. A toy building element as defined in claim 2, further comprising at least one pair of resilient partitions intermediate said lateral walls and spaced from each other and substantially parallel to each other and to said lateral walls, and one of said saw-tooth-shaped projections on one side of each partition and pointing toward the nearer of said lateral walls and operatively associated with the projection on said nearer lateral wall to permit at least one of said connecting members of another toy building element to be inserted between them.

4. A toy building element as defined in claim 2, further comprising at least one resilient partition between and substantially parallel to said lateral walls and connected at least to one of said walls, said partition being operatively associated with the projection on one of said lateral walls to permit at least one of said connecting members of another toy building element to be inserted between them.

5. A toy building element as defined in claim 1, wherein said stud-like connecting members are tubular so that the inner space of the building block becomes accessible through the aperture in said tubular stud-like connecting member.

6. A toy building element as defined in claim 1, wherein at least two of said walls connected to said first wall are provided with reinforcing ribs.

7. A toy building element as defined in claim 1, wherein each of said saw-tooth-shaped projections in said building element is inclined so as to form an acute angle between the lower surface of said projection and the vertical plane coextensive with the inner surface of the wall above said projection, and an obtuse angle between the

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upper surface of said projection and said vertical plane, so that a stud-like connecting member of another building element may be easily inserted between said saw-tooth-shaped projections in said first element whereby said lateral walls are bent outwardly until said connecting member is fully inserted into said first element when said projections snap behind said bead on said connecting member, whereas it requires a greater force to pull said beaded connecting member out of said first element.

8. A toy building element as defined in claim 1, wherein said saw-tooth-shaped projections on the inner surfaces of said lateral walls serve as a glide path for the said bead on the stud-like members, such that two building elements, when joined in a position offset against each other by 90°, will be slidable relative to each other in the joined position.

9. A toy building element of a hollow box-like shape having an open side extending in a horizontal plane, a first wall opposite and parallel to said plane, locking means for connecting two said elements, said locking means including stud-like connecting members projecting at right angles from the outer side of said wall, a pair of opposite lateral walls substantially parallel to each other and secured to each other at least by said first wall and extending substantially at right angles thereto and being resiliently flexible toward their free ends at said open side, and mutually opposite substantially rigid end walls secured to said first wall and said lateral walls and extending at right angles thereto, said lateral walls having a greater length than said end walls, and a resilient partition between and substantially parallel to said lateral walls, and connected at least to one of said walls, said locking means further including a saw-tooth-shaped projection on the inner sides of each of said lateral walls near said open side and on each side of said partition, respective ones of said partition projections pointing toward the adjacent one of said lateral walls, said projections on said partition being operatively associated with the projections on the respective adjacent lateral wall to permit at least one of said connecting members of another toy building element to be inserted between them.

10. A toy building element as defined in claim 9, wherein said partition has a thickness different from that of said lateral walls.

11. A toy building element as defined in claim 9, wherein said partition has a degree of resilience different from that of said walls.

12. A toy building element as defined in claim 9, wherein said saw-tooth-shaped projections on said partition have a shape different from that of said projections on said lateral walls.

13. A toy building element as defined in claim 9, wherein said saw-tooth-shaped projections on said partition are vertically offset relative to those on said lateral walls.

14. A toy building element as defined in claim 9, wherein said partition is provided with at least one transverse aperture.

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