Feb. 15, 1966 E. FRANKL 3,234,682

SELF-ERECTING BUILDING BLOCK

Filed Nov. 2, 1962 3 Sheets-Sheet 1

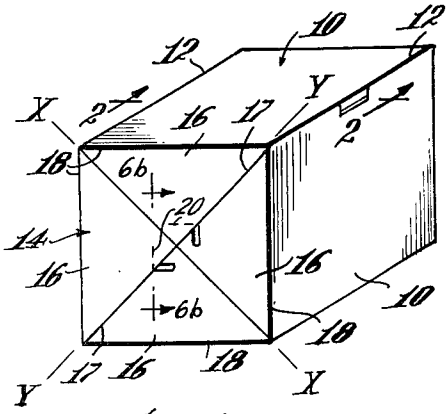


Fig. 1

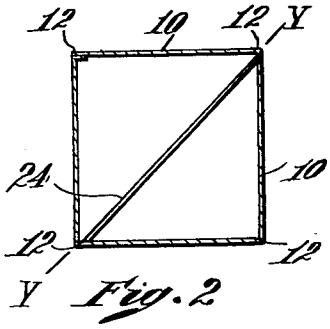


Fig. 2

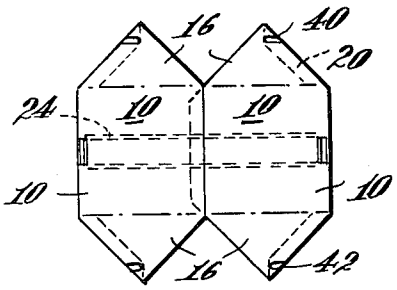


Fig. 3

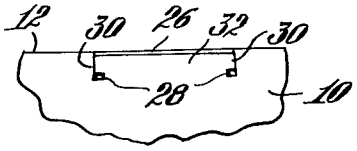


Fig. 4

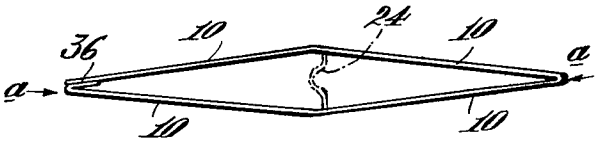


Fig. 6a

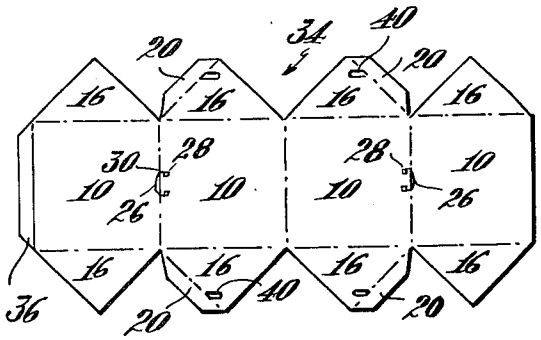


Fig. 5

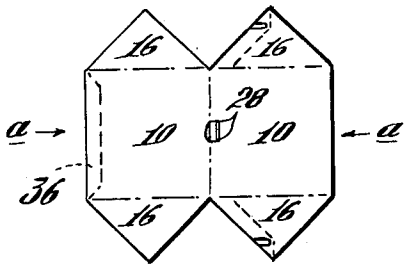


Fig. 6

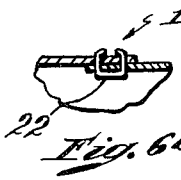


Fig. 6b

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ATT'YS

SELF-ERECTING BUILDING BLOCK

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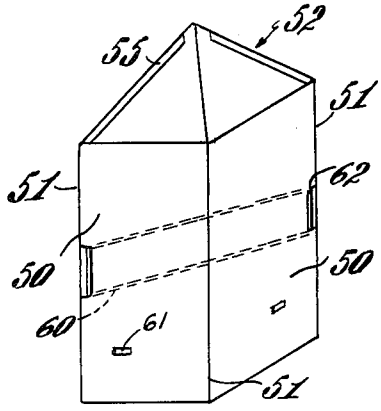


Fig. 7

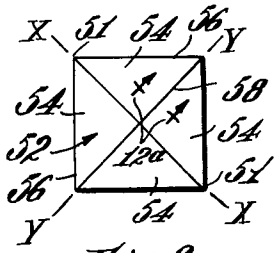


Fig. 8

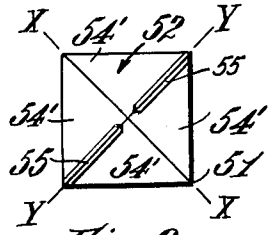


Fig. 9

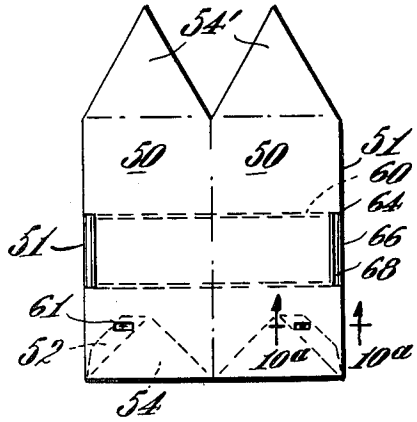


Fig. 10

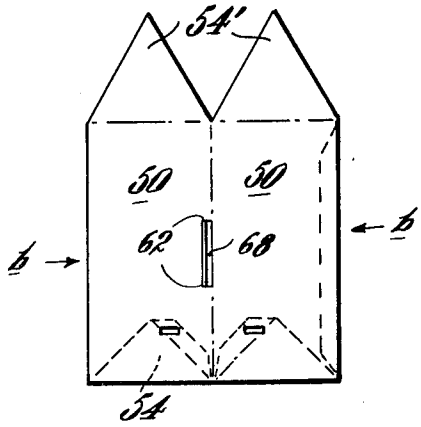


Fig. 12

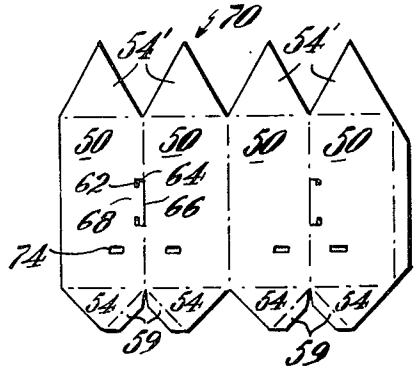


Fig. 11

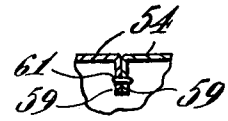


Fig. 12a



Fig. 10a

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SELF-ERECTING BUILDING BLOCK

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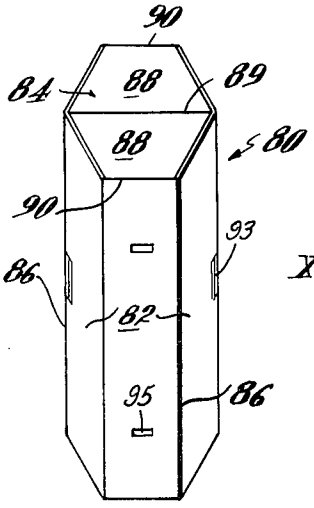


Fig. 13

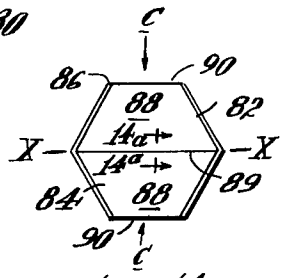


Fig. 14



Fig. 14a

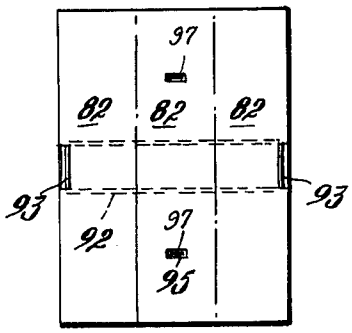


Fig. 15

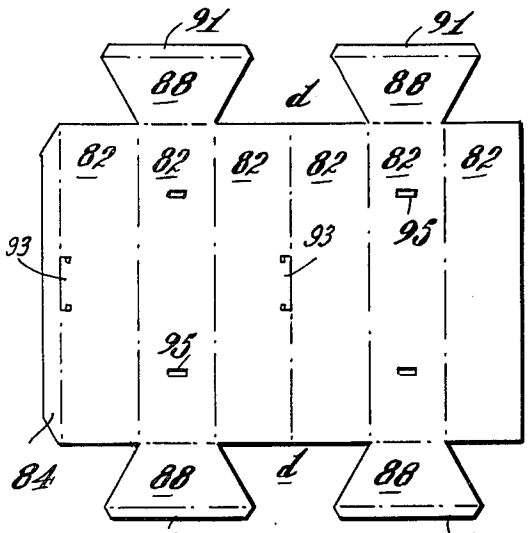


Fig. 16

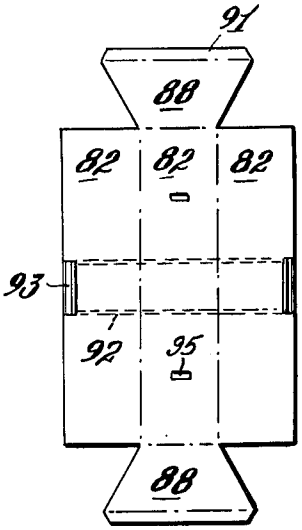


Fig. 18

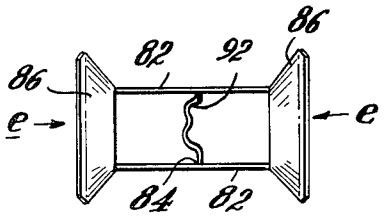


Fig. 17

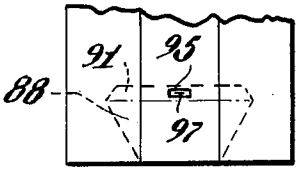


Fig. 19

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SELF-ERECTING BUILDING BLOCK

Ernest Frankl, Middleboro, Mass., assignor to Winthrop-Atkins Co., Inc., Middleboro, Mass., a corporation of Massachusetts

Filed Nov. 2, 1962, Ser. No. 235,043
3 Claims. (Cl. 46—24)

This invention relates to hollow structures and has for its principal objects to provide such structures in the form of units of different configuration which may be used individually or collectively to build toy or advertising structures of considerable size, but which may be collapsed so as to be individually, substantially flat for storage when not in use. Other objects are to provide unit structures which are normally held elastically distended when unconstrained, resist collapse sufficiently to support each other when assembled to form a composite structure, are sturdy, light-weight, susceptible of decoration, and can be manufactured easily and inexpensively from sheet paperboard, or the like, by the simple expedient of die-cutting.

As herein illustrated, the structure is a hollow body of polygonal right section comprised of a plurality of side walls arranged symmetrically with respect to its longitudinal axis. The side walls are joined edge-to-edge by hinges, a tension member is secured under tension to the side walls, transversely of the structure, at opposite ends of a predetermined median, and there are transverse tension-resisting members at the ends of the structure disposed at right angles to the aforesaid median with their opposite ends connected, respectively, at the opposite sides of the median. The tension-resisting end members are foldable at the median to permit collapse of the structure into the plane of the median.

In accordance with the method of manufacture, a blank having a plurality of substantially rectangular panels hingedly joined edge-to-edge adapted, when folded, to form a hollow body symmetrical with respect to the longitudinal axis and a plurality of end parts hingedly connected to the ends of the respective panels adapted, when folded, collectively to form end members corresponding in configuration to the transverse section of the structure, is folded midway between its ends and the ends secured. An elastic element is secured at its ends between a pair of opposed hinges intermediate the ends of the folded blank whereupon the blank is refolded so that the hinges to which the ends of the elastic element are connected now become the ends of the folded blank thereby placing the elastic element under tension, whereupon the edges of the end parts, parallel to the elastic element, are secured together. The edges of the end parts are secured by flanges folded inwardly between the parts and joined by staples driven through holes in the parts.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

FIG. 1 is a perspective view of a hollow unit structure of rectangular right-transverse section, the ends of which are parallel;

FIG. 2 is a vertical section taken on the line 2—2 of FIG. 1;

FIG. 3 is a plan view of the structure collapsed so that it is substantially flat;

FIG. 4 is a fragmentary elevation adjacent the upper corner at the right side of FIG. 1;

FIG. 5 is a plan view of the blank for making the block;

FIG. 6 is a plan view of the blank after it has been folded medially;

FIG. 6*a* is an end view of the medially folded blank in the first stage of refolding showing the fastening element secured to two opposed hinges;

FIG. 6*b* is a fragmentary section taken on the line 6*b*—6*b* of FIG. 1;

FIG. 7 is a perspective view of a structure having a body portion of rectangular right-transverse section, a flat bottom, and a top of pyramidal shape;

FIG. 8 is a plan view of the bottom;

FIG. 9 is a plan view of the top;

FIG. 10 is a plan view of the structure collapsed so that it is substantially flat;

FIG. 10*a* is a section taken on the line 10*a*—10*a* of FIG. 10;

FIG. 11 is a plan view of the blank;

FIG. 12 is a plan view of the blank after it has been folded medially;

FIG. 12*a* is a section taken on the line 12*a*—12*a* of FIG. 8;

FIG. 13 is a perspective view of a hexagonal structure;

FIG. 14 is a top or end view of a hexagonal structure;

FIG. 14*a* is a section taken on the line 14*a*—14a of FIG. 14;

FIG. 15 is a plan view of the hexagonal structure collapsed so that it is substantially flat;

FIG. 16 is a plan view of the blank;

FIG. 17 is a section of the blank in one stage of folding;

FIG. 18 is a plan view of the blank in a second stage of folding; and

FIG. 19 is a fragmentary plan view of the folded blank ready to be secured.

Referring to the drawings, the structure shown in FIG. 1 is a hollow block of right-rectangular, transverse section having rectangular side walls **10** joined along their longitudinal edges by hinges **12** and end walls **14** comprised of triangular parts **16** connected to the transverse or end edges of the side walls **10** by hinges **18**. The adjacent edges of each two end parts **16**, meeting in the diagonal plane Y—Y, are connected by hinges **17**. As illustrated, each hinge **17** is constituted by tabs **20** hinged to the edges of the sections **16** and secured to each other by staples **22** (FIG. 6*b*). Fastening means of any suitable kind may be substituted for the staples. The edges of each two end parts **16**, meeting in the diagonal plane X—X at right angles to the diagonal plane Y—Y, are unconnected. The hinges connecting the several parts may be of any suitable structure, formed, for example, of paper or fabric adhered to the adjoining edges to provide a flexible hinge, or simply by scoring, embossing or creasing the sheet material.

A tension element **24** (FIG. 2) in the form of an elastic band is disposed within the structure, under tension, with its opposite ends secured to the side walls **10** adjacent the opposed hinges **12—12** in the diagonal plane Y—Y. To secure the ends of the band, each of the opposed hinges **12—12** in the diagonal plane Y—Y is slit lengthwise at **26** (FIG. 4) and one of the adjacent walls **10** is provided with holes **28—28** through it, adjacent the ends of the slit. The ends of the slit **26** are connected to the two holes **28—28** by slits **30—30**. The slits **26**, **30** and holes **28** provide tabs **32** about which the ends of the band **24** are looped. The band tends to pull the opposite corners **12—12** in the diagonal plane Y—Y toward each other and to push the opposed corners **12—12** in the diagonal plane X—X away from each other. The hinged part **16** at opposite sides of the diagonal plane X—X acts as tension-resisting members and, by resisting the tension in the elastic band which tends to push the corners **12—12** in the diagonal plane X—X away from each other, hold the structure expended.

As thus constructed, pressure applied to the corners of the structure intersected by the diagonal plane X—X will fold the end parts **16** on their hinges **17** thereby stretching the elastic band, pushing the corners intersected

by the diagonal plane Y—Y away from each other so as to collapse the structure. When collapsed, the two walls at one side of the diagnoal plane Y—Y and the two walls at the other side of the diagonal plane Y—Y will occupy parallel planes, and the end parts **16** will extend from opposite ends of the walls in parallel relation as shown in FIG. 3. Such distortion and flattening of the structure stretches the elastic band **24**, placing it under such tension that as soon as the pressure is removed the structure will spring back to its original shape.

The structure is made up from a blank **34** (FIG. 5) of very simple configuration which may be cut from sheet material in a single die-cutting operation. The flat blank, as shown, has four substantially rectangular panels **10** which are the side walls of the completed structure, at the ends of which are triangular parts **16** which, as heretofore pointed out, collectively form the end walls of the structure. A tab **36** is provided along the edge of one of the end wall panels **10** and the tabs **20** are provided along an edge of each of the parts **16** at the ends of the two intermediate panels. The slits **26**, holes **28—28**, and slits **30—30** joining the holes **28** to the slits **26**, and the hinges connecting the several parts are made at the same time that the blank is die-cut. Holes **40** are cut through the parts **16** at the ends of the two intermediate panels **10** for a purpose which will appear hereinafter.

The first step in forming the structure in the blank **34** is to fold the blank intermediate its opposite ends so that the two wall panels **10—10** in one half, and their triangular parts **16—16** are parallel to the two wall panels **10—10** and their triangular parts **16—16** as shown in FIG. 6. The flap **36** is folded inwardly between the panels so as to secure the ends of the blank to each other, for example, by means of adhesive or staples. In this phase of assembly, the holes **28—28** in the two halves of the blank, as shown in FIG. 6, coincide with each other so that the ends of an elastic band may be inserted through the slots **26** and drawn through the slots **30—30** into the holes **28—28** so as to be looped about the tabs **32**, while the band is in a relaxed, that is in untensioned condition (FIG. 6*a*). Having inserted the elastic band and secured its ends about the tabs **32**, pressure is applied to the edges of the folded blank in the direction of the arrow *a—a*, as shown in FIGS. 6, 6*a*, so as to refold the blank to a position such as shown in FIG. 3, in which the opposed hinges **12—12**, to which the elastic band is secured, are spread apart thus placing the elastic band under tension. The structure is completed while the blank is held constrained in this refolded position by folding the tabs **20** inwardly between the parts **16** and then driving staples **22** through the holes **40** to secure the tabs **20** to the parts **16**. The holes **40** in the parts **16** permit driving the fastening elements into the tabs between them from exteriorly while the structure is collapsed. When the tabs have been secured the structure is completed and will spring up into its fully expanded position when released.

FIGS. 7 to 12*a* inclusive, show an alternative structure of rectangular right-transverse section having side walls **50** and end walls **52**. The side walls are connected by hinges **51**. At one end the end wall **52** (FIG. 8) is comprised a triangular parts **54** which are connected by hinges **56** to the end edges of the side wall **50**. The adjacent edges of the end parts **54**, meeting in the diagonal plane Y—Y, (FIG. 8) are connected by hinge means **58**, for example tabs **59** (FIG. 12*a*) hingedly connected to the parts and to each other by staples **61**. The edges of the parts **54**, meeting in the diagonal plane X—X, are unconnected. The triangular parts **54**, collectively forming the end **52**, lie in a common plane at right angles to the side walls. At the other end the end wall **52** is comprised of triangular parts **54'** which are so dimensioned as collectively to form, when disposed edge-to-edge, a quadrilateral pyramid. The edges of the parts **54'**, meeting in the diagonal plane Y—Y, are hingedly connected to each other and the edges meeting in the diagonal plane X—X are unconnected. Tabs, hingedly connected to the edges of the parts and stapled together may be employed, or the adjacent edges may be secured by means of separate strips **55** of flexible adhesive-coated sheet material (FIG. 9)applied to the edges at each side of the apex.

An elastic element **60** is secured at its ends to the side walls between the opposed hinges **51—51**, adjacent the ends of the diagonal plane Y—Y, and to this end holes **62—62** are provided in one of the side walls adjacent each hinge. The holes **62—62** at each hinge are connected by slits **64—64** to the ends of a slit **66** extending along the hinge **51**, so as to provide a retaining or anchoring tab **68** over which the ends of the elastic band are looped. The diagonally disposed elastic band tends to pull the corners to which its ends are attached toward each other and simultaneously to spread the opposite corners apart. Spreading of the opposite corners is, however constrained by the inelastic character of the hinged end parts **54'** which, under tension, resist the stress in the elastic band thereby holding the structure expanded.

By applying pressure to the corners of the structure intersected by the diagonal plane X—X, the end parts **54** and **54'** may be folded on their hinges, the elastic band stretched, and the corners intersected by the diagonal plane Y—Y spread apart so as to collapse the structure. When collapsed, as shown in FIG. 10, the walls **50** at one side of the diagonal plane Y—Y are parallel to those at the other side and the elastic band **60** is under tension. When the collapsing pressure is released, the structure will spring up quickly. In the flattened condition, the end parts **54** at the bottom of the structure fold inwardly between the side walls.

The structure is made from a blank **70**, as shown in FIG. 11, comprised of four side wall panels **50** hingedly joined at their edges, each of which has a triangular end part **54** and **54'** hinged thereto. The two end parts **54** of each half of the blank have at their adjacent edges tabs **59**. During formation of the blank the holes and slots **62**, **64** and **66** are cut to form the tabs **68**. Additional holes **74** are cut in the side walls. The blank, as thus formed, is folded on its median to bring the two side walls at one side of the median into parallel relation to the two side walls at the other side and to bring the holes **62—62** of the two end side walls into registration, as shown in FIG. 12. The ends of the elastic band **60** are now inserted into the holes **62—62** so as to be looped about the tabs **68** whereupon pressure is applied to the edges in the direction of the arrows *b—b* (FIG. 12) to refold the blank to cause it to take the shape shown in FIG. 10 in which the ends of the elastic band are attached or spaced apart, and the band is under tensioned. During refolding the end parts **54** are folded inwardly so as to lie between the side walls. As thus folded, the flanges **59** of the end parts **54** have contact with each other and portions of these flanges are situated between the openings **74**, thus permitting staples **61** (FIG. 12*a*) to be driven into the flanges to secure them together. Correspondingly, staples may be driven into the end parts **54'** by providing suitable tabs and holes such, for example, as shown in FIG. 3 of the form of the invention shown in FIGS. 1 to 5, or the edges of the parts **54'** may be secured by means of adhesive tape **55** applied to the exterior sides thereof as referred to above. When the end parts have been secured in suitable fashion, release of the pressure will permit the elastic to restore the collapsed structure to its expanded position.

A third form of the invention is shown in FIGS. 13 to 19 inclusive, which is of hexagonal right-transverse section. The structure **80** has side walls **82** and end walls **84**. The side walls are connected to each other by hinges **86**

and are of equal width and are symmetrically disposed with reference to the longitudinal axis of the structure. The end walls 84 are comprised of trapezoidal parts 88 which are connected at their adjacent base edges to each other by hinge means 89 and along the edges parallel to their base edges to the side walls 82 by hinge means 90. The end edges of the trapezoidal parts 88 are unconnected to the side walls. One or more elastic bands 92 are connected at their ends under tension to the opposed hinges at opposite ends of the median X—X and the tension of the elastic band or bands is opposed by the inelastic resistance afforded by the hinged end parts 88. The ends of the elastic bands are connected to the walls in the same fashion as illustrated in FIG. 4 by means of tabs 93 formed in the wall adjacent the connecting hinge, about which the ends of the bands are looped.

As thus constructed, by applying pressure to the structure in the directions of the arrows *c*—*c*, as shown in FIG. 14, the end parts 88 are caused to fold on their hinges 89 and the side walls at each side thereof are brought into parallel relation with each other and with the end wall parts 88 situated therebetween. The flattened position of the structure is illustrated in FIG. 15, in which a single elastic band 92 is shown in a stretched condition so that when the structure is released it will be restored to its original position.

The blank for making the structure (FIG. 16) comprises six side wall panels 82 hingedly connected to each other along adjacent edges, a tab 84 at one end and the trapezoidal end parts 88, together with the fastening tabs 91. The hinges connecting the several parts and the tabs for receiving the ends of the elastic band are formed during the die-cutting operation. Additional holes 95 are cut in the walls to permit securing the tabs 91 at the edges of the end parts 88.

The blank is first folded on the hinge *d*—*d* (FIG. 16) to form a substantially rectangular structure (FIG. 17) in which the tab 84 overlaps the edge of the opposite end panel. The tabs 93 for receiving the ends of the elastic band 92 lie opposite each other at this stage of formation, close enough to permit engaging the ends of the elastic band with them without having to be stretched. After having applied the elastic band the partially folded structure is reformed by applying pressure thereto in the direction of the arrow *e*—*e* (FIG. 17) so as to fold the side walls at opposite sides of the elastic band into parallel planes as shown in FIG. 18 thus stretching the band. The end parts 88 are now folded in between the side walls to positions in which the tabs 91 lie between the openings 95, as shown in FIG. 19, whereupon staples 97 are driven through the tabs to fasten them together. The structure is now complete and when released the rubber band will expand the structure to its final shape.

In each form of the invention and such variations as may be made thereto within the scope of the appended claims, the outer surfaces of the side walls and end walls may be covered with decorative paper or other decorative adjuncts to conceal the staple openings and the anchored ends of the elastic band or bands.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. A hollow toy building block of polygonal transverse section having side walls symmetrically disposed with respect to its longitudinal axis, said side walls being hingedly connected parallel to said longitudinal axis, an elastic element secured at its ends under tension to two of the side walls across at least one of the hinges connecting the side walls, and tension-resisting members at the ends of the block, said tension-resisting members comprising end wall parts constituted by integral extensions of the ends of the side walls at one end of the block, folded inwardly therefrom across said end of the block toward each other, said end wall parts having edges which meet midway between the side walls from which they extend parallel to the elastic element, means connecting the meeting edges of said end wall parts, said means comprising a tab hingedly connected to the edge of at least one of the end wall parts and located interiorly of the end, and fastening means connecting the tab to the adjacent end wall part and slot means in one of the walls of the block through which the fastening means may be inserted to connect said interiorly located tab to the adjacent end wall part.

2. A hollow structure having four rectangular side wall parts symmetrical with respect to its longitudinal axis, hinges joining the longitudinal edges of the side wall parts to each other, an elastic element secured under tension at its ends to two adjacent side wall parts across the hinge therebetween in elastic tension-resisting end wall parts at the ends of the structure, hinges connecting the opposite ends of end wall parts to the side wall parts at each side of the elastic element, hinges connecting the adjacent ends of said end wall parts midway between their opposite ends to each other for articulation on axes parallel to the elastic element, said hinges comprising tabs at the adjacent ends of the end wall parts, said tabs being situated interiorly of said end wall parts, and fastening elements securing the tabs to each other, hole means in individual ones of said wall parts through which access may be had to insert the fastening elements into the adjacent tabs to secure them to each other.

3. A hollow collapsible toy building block having side and end walls, said side wall comprising integrally hinged side wall parts formed about a common axis as a center with three of said side wall parts at each side of a plane containing said axis, said side wall parts being symmetrically arranged with respect to said axis and including at each side of said plane, one side wall part parallel to said plane and two side wall parts at angles to said plane, each end wall comprising two end wall parts, constituted by integral extensions of the side wall parts parallel to said plane, folded inwardly therefrom across the ends of the block, said end wall parts being symmetrical with respect to said axis and each of said two end wall parts having edges parallel to the ends of the side wall parts and edges meeting midway between the parallel side wall parts, hinges joining the side wall parts to each other, hinges joining the meeting edges of the end wall parts, the edges parallel to the ends of the side wall parts at angles to said plane being unconnected thereto, and elastic elements secured under tension at their ends to the side wall parts at opposite sides of said plane, said hinges joining the meeting edges of the end wall parts comprising tabs at the meeting edges engaged with each other within the block and joined to each other by fastening means, and opening means in individual ones of said wall parts through which fastening elements may be inserted to join adjacent tabs.

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