Feb. 23, 1971 A. N. WILLIS 3,564,758

POLYGONAL BUILDING ELEMENTS WITH CONNECTORS THEREFOR FOR ASSEMBLING TOY STRUCTURES

Filed Sept. 4, 1968 3 Sheets-Sheet 1

Fig. 1.

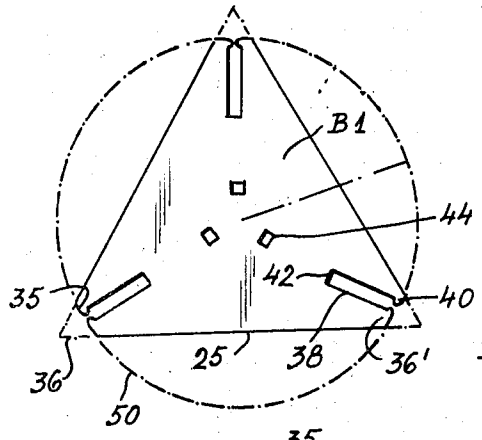
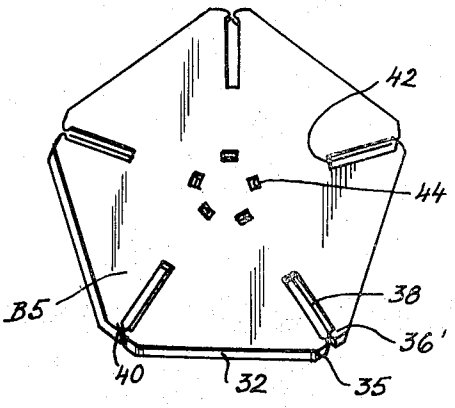


Fig. 6.



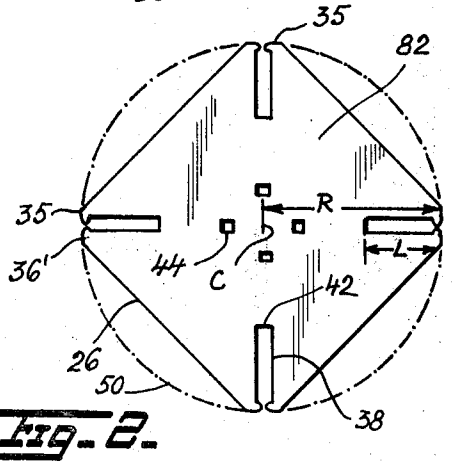


Fig. 2.

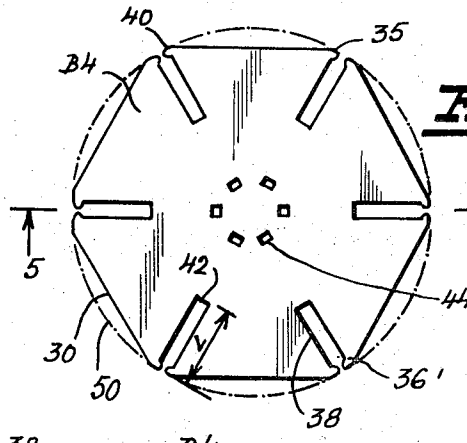


Fig. 4.

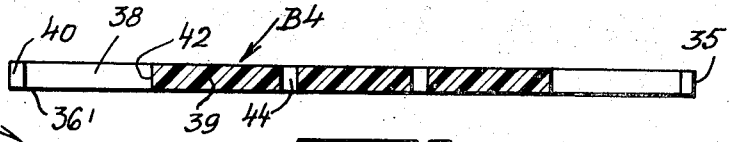


Fig. 5.

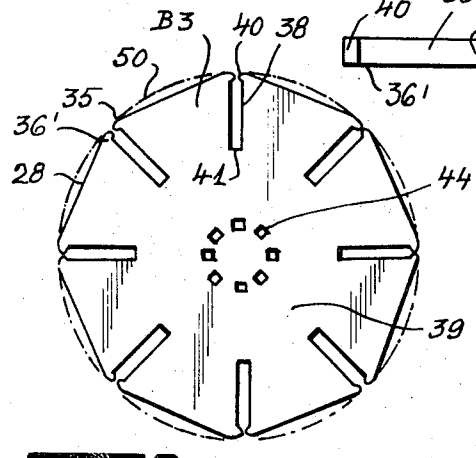


Fig. 3.

INVENTOR

Arthur N. Willis

BY Polachek & Saulsbury

ATTORNEYS

Feb. 23, 1971 A. N. WILLIS 3,564,758

POLYGONAL BUILDING ELEMENTS WITH CONNECTORS THEREFOR FOR ASSEMBLING TOY STRUCTURES

Filed Sept. 4, 1968 3 Sheets-Sheet 2

Fig. 6.

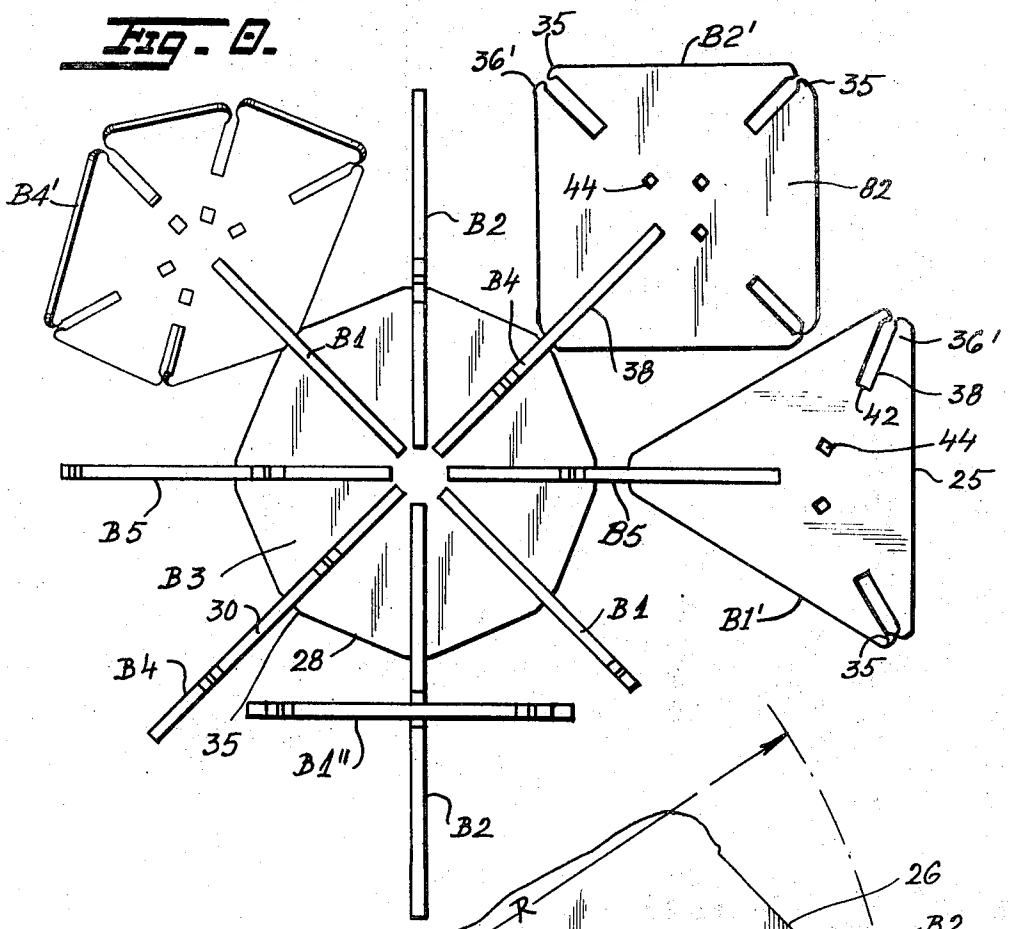
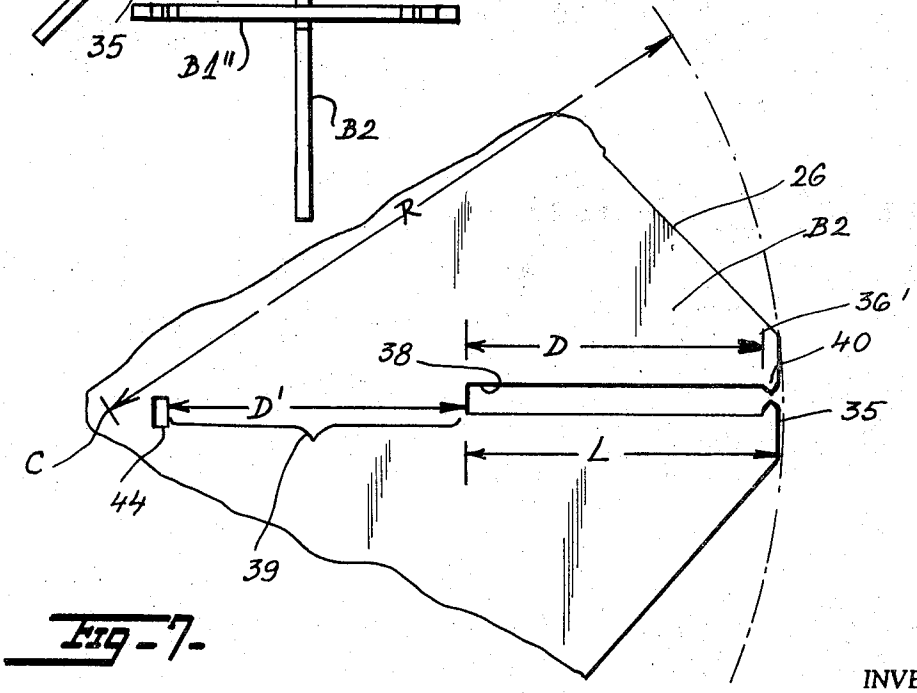


Fig. 7.



INVENTOR

Arthur N. Willis

BY Polachek & Saulsbury

ATTORNEYS

Feb. 23, 1971 A. N. WILLIS 3,564,758

POLYGONAL BUILDING ELEMENTS WITH CONNECTORS THEREFOR FOR ASSEMBLING TOY STRUCTURES

Filed Sept. 4, 1968 3 Sheets-Sheet 3

Fig. 9.

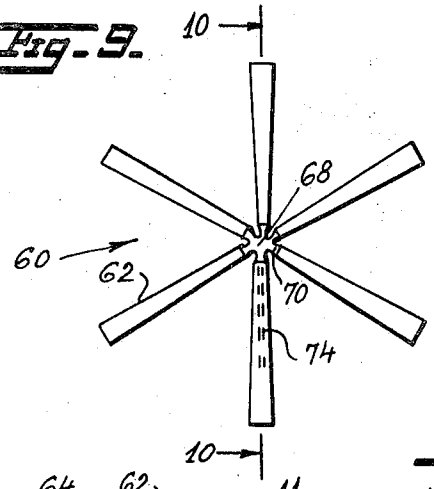


Fig. 14.

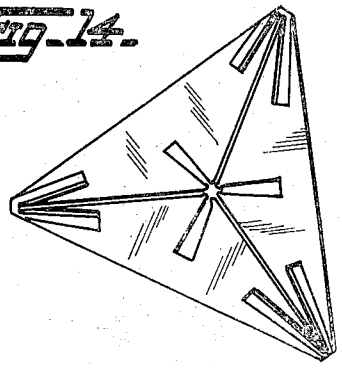


Fig. 10.

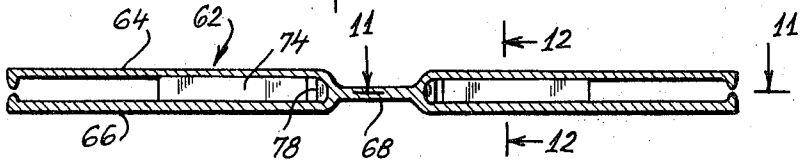
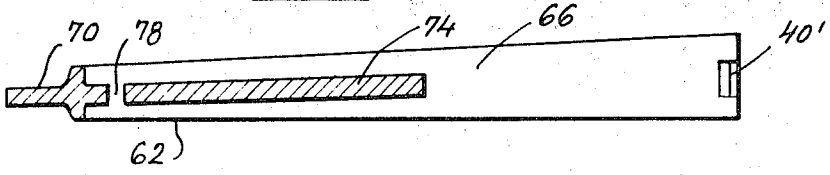


Fig. 11.



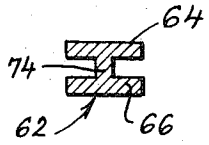


Fig. 12.

Fig. 16.

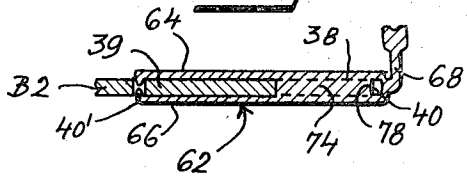
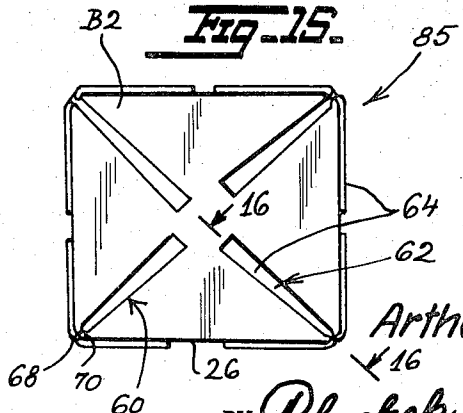


Fig. 15.



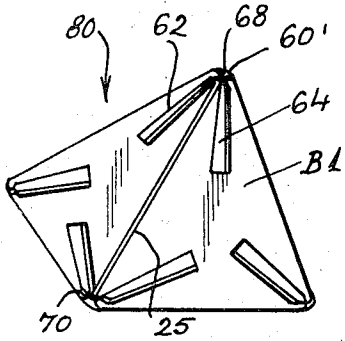


Fig. 13.

INVENTOR

Arthur N. Willis

BY Blachek & Saulsbury

ATTORNEYS

United States Patent Office 3,564,758 Patented Feb. 23, 1971

3,564,758

POLYGONAL BUILDING ELEMENTS WITH CONNECTORS THEREFOR FOR ASSEMBLING TOY STRUCTURES

Arthur N. Willis, 706 Plume St.,
Spartanburg, S.C. 29302

Filed Sept. 4, 1968, Ser. No. 757,281
Int. Cl. A63h *33/10*
U.S. Cl. 46—31 3 Claims

ABSTRACT OF THE DISCLOSURE

Flat disc elements in the form of regular polygons have radial notches at corners thereof to interfit and interlock for forming toy geometric structures of various shapes. Notches may have projections to engage in holes in interfitted discs. Webs with multiple arms are also provided for engaging corners of a plurality of polygonal elements to form polyhedrons.

The invention relates to the art of interlocking building elements for toy structures.

According to the invention there is provided a multiplicity of flexible, flat disc elements, each having a regular polygonal form such as triangle, square pentagon, hexagon, octagon, decagon, etc. All the elements have radii of equal length, and all can be fitted to a circle of given size. Stated another way, all of the elements are to be considered as inscribed in circles of equal radius. Each element has a notch or slit extending radially inward from each corner for interfitting each element with other elements. Each notch may be formed with inwardly extending opposing projections or teeth at its open end. These projections can engage in holes formed around the centers of the elements in alignment with the corner notches. In order to facilitate arranging a plurality of like regular polygonal elements to form polyhedrons, novel flexible web members are provided for engaging the notches of the polygonal elements.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

FIGS. 1–4 are plan views of polygonal disc elements according to the invention.

FIG. 5 is an enlarged cross sectional view taken on line **5—5** of FIG. 4.

FIG. 6 is an oblique plan view of another polygonal disc element.

FIG. 7 is an enlarged plan view partially diagrammatic in form, of a portion of the disc element of FIG. 2.

FIG. 8 is a plan view of an assembly of polygonal disc elements.

FIG. 9 is a plan view of a web member useful for assembling polyhedrons.

FIG. 10 is an enlarged cross sectional view taken on line **10—10** of FIG. 9.

FIG. 11 is a further enlarged fragmentary sectional view taken on line **11—11** of FIG. 10.

FIG. 12 is a further enlarged cross sectional view taken on line **12—12** of FIG. 10.

FIG. 13 is a perspective view of a tetrahedron assembled with triangular building elements, according to the invention.

FIG. 14 is a top plan view of the polyhedron of FIG. 13.

FIG. 15 is a side view of a cube or rectangular polyhedron constructed of square building elements, according to the invention, and

FIG. 16 is an enlarged fragmentary sectional view taken on line **16—16** of FIG. 15.

Referring first to FIGS. 1–7, there are shown disc shaped toy building elements B1–B5. Element B1 is triangular. It has three intersecting edges **25**. Element B2 is square with four long edges **26**. Element B3 is octagonal with eight sides or edges **28**. Element B4 is hexagonal with six sides or edges **30**. Element B5 is pentagonal with five sides or edges **32**. Each corner **35** of each element is blunt. The sharp corners **36** indicated by dotted lines in FIG. 1 are omitted or cut off when the elements are made.

Each element has a notch or slot **38** extending radially inward from the blunt corner **35**. The lengths L of the notches are the same and each is slightly less than one half the corner radius R of the element; see FIG. 7. Radius R is also the radius of circumscribed circle **50**. Projections or teeth **40** are formed at the open ends of the notches on opposing edges of the notches. The distance D from each tooth to the end **42** of each notch **38** is equal to distance D′ from notch end **42** to a hole **44** located near center C of the disc element. Holes **44** are circumferentially arranged around center C. The holes **44** are aligned radially with the radii of the notches **38**.

Each disc element is formed of flexible sheet material. It can be plastic, metal, paper or other suitable material. Adjacent corner portions **36′** at the notches of each element can be spread apart for insertion and engagement of another polygonal element into the notch. All the elements will interfit because all elements can be considered as inscribed in circles **50** of equal radius, as indicated by dot and dash lines in FIGS. 1–4.

FIG. 8 shows how a multiplicity of polygonal elements can be interfitted to form a three dimensional multiple polygonal structure **55**. As an example, there is octagonal element B3 on which two square elements B2 are engaged in coplanar alignment perpendicular to element B3. Also two pentagonal elements B5, two triangular elements B1, and two hexagonal elements B4 are perpendicular to element B3. In addition a hexagonal element B4′ is engaged on one triangular element B1; a triangular element B1′ is engaged on one pentagonal element B5; a square element B2′ is engaged on one hexagonal element B4; and a triangular element B1″ is engaged on one square element B2. It will be apparent that an infinite number of constructions and structures can be set up by using a multiplicity of polygonal elements of various shapes.

The elements can be attractively colored. Each element can be of one color or of several colors. The element can have patterns or designs upon them of one or several colors.

When the elements are interfitted as shown in FIG. 8, the sides of each notch **38** engage frictionally on the imperforate portions **39** of the elements between notch ends **42** and the holes **44**. In addition, the projections or teeth **40** engage in the holes **44**. The set up structure will thus be stable. The interfitted and interlocked elements will not fall apart, and will stay together until the entire structure is disassembled.

FIG. 9 shows a web member **60** which is used in setting up polyhedrons. The web member has a multiplicity of radial arms **62**. Each arm has two spaced, flat tapered flanges **64, 66** integrally formed with a central web **68**. Each arm is joined by a flexible, pliable neck **70** to web **68**. A central flange **74** integrally joins the flanges **64, 66**. This flange is spaced inwardly from the open, free ends of the arms. A discontinuity or hole **78**

is formed in each flange **74** near the inner end of the arm. At the outer ends of flanges **64**, **66** are formed inner opposing projections or teeth **40'**.

Polygonal elements B1–B5 and others can be engaged with the arms of the web member which will serve as coupling means for joining a plurality of flat polygonal elements. Any one or more arms **62** can be removed by tearing or cutting at a neck **70**. Only three arms are required for each web member used in assembling a polyhedron from regular polygonal elements. Thus as shown in FIGS. 13 and 14, a tetrahedron **80** has four web members **60'**. Each web member has three arms **62** engaged with and coupling three triangular elements B1. The tetrahedron has four triangular elements, so four web members are employed. The triangular base element of the tetrahedron is not visibly shown in the drawing.

FIGS. 15 and 16 show a polyhedron **85** made with square polygonal elements B2. Six such elements are required to form a cube. Eight web elements **60''** each with three arms **62** are required to attach six elements together. As clearly shown in FIG. 16, the webs **68** are located at corners of the polyhedron. The flange **74** of each arm **62** is frictionally engaged by side edges of a notch **38** of polygonal element. The projections or teeth **40** engage in hole **78** of flange **74**. Inner sides of flanges **64**, **66** engage frictionally with the imperforate radial portion **39** of the element and projections **40'** of the flanges **64**, **66** engage in hole **44** of the disc shaped building element. The arms **62** are bent angularly at web **68**. In cube **85** the arms **62** are bent 90° to each other. In the triangular polyhedron **80** arms **62** are bent 60° to each other.

It will be apparent that all of the other regular polygonal shapes shown in the drawings, and others not shown can be arranged to form polyhedrons.

The building elements described can serve as a very educational and entertaining toy and game. The disc elements can be made up in any desired size. They can be die-cut or stamped from sheet stock; they can be molded by mass production plastic molding machinery; or they can be made in other ways well known in disc manufacturing arts. The building elements can be made at low cost in durable attractive forms.

It should be strongly noted that while the "teeth" **40** and "holes" **44** are generally desirable, they are optional for most applications. This is particularly true where it is not desired that the "web" be used or that polyhedrons be formed.

While I have illustrated and described the preferred

embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

What is claimed is:

1. Toy building structures, comprising a plurality of flat flexible disc elements, each of said elements having substantially the form of a regular, equilateral polygon with a notch extending radially inward from each corner of the polygonal element a distance less than half of the length of each corner radius of the element, so that all elements can be interfitted and interlocked by mutually engaging each said element with at least one other of said elements at their notched corners with edges of each engaged notch receiving said other element and frictionally gripping the opposite sides of said other element along the corner radius thereof; and coupling means cooperable with said notches including web members for detachably joining a plurality of said disc element in corner-to-corner coplanar relationship to thereby form a structure foldable to form a regular polyhedron having said joined disc elements as its sides, said web members having radial arms with flanges for engaging in corner notches of adjacent disc elements.

2. Toy building structures as defined in claim **1**, wherein notches at the corners of all the disc elements are of equal length.

3. Toy building structures as defined in claim **1**, wherein each disc element has a plurality of centrally located circumferentially spaced holes aligned with the respective notches, and wherein each notch is formed with opposing teeth at its outer end for engaging in one of the holes of an engaged disc element.

References Cited

UNITED STATES PATENTS

2,446,120	7/1948	Wiswesser	46—30X
2,633,662	4/1953	Nelson	46—25
3,120,078	2/1964	Bessinger	46—31
3,412,519	11/1968	Brettingen	46—26X

FOREIGN PATENTS

266,913	2/1950	Switzerland	46—25

F. BARRY SHAY, Primary Examiner

U.S. Cl. X.R.

35—72; 46—25; 161—13