

May 30, 1972

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3,666,607

BLANK FOR CONSTRUCTION SOLID FORMS

Filed Sept. 3, 1968

5 Sheets-Sheet 1

FIG. 1

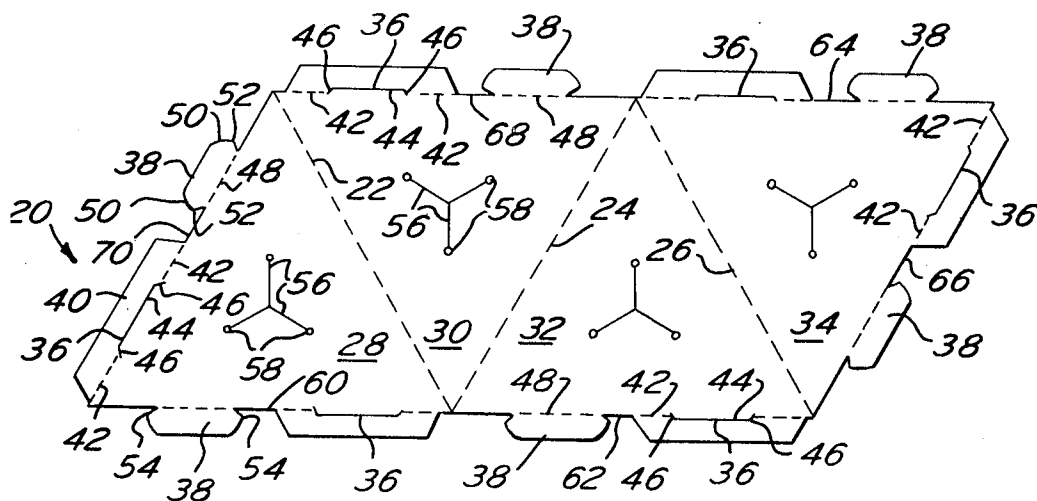


FIG. 3

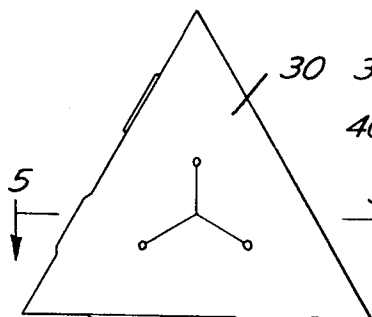


FIG. 2

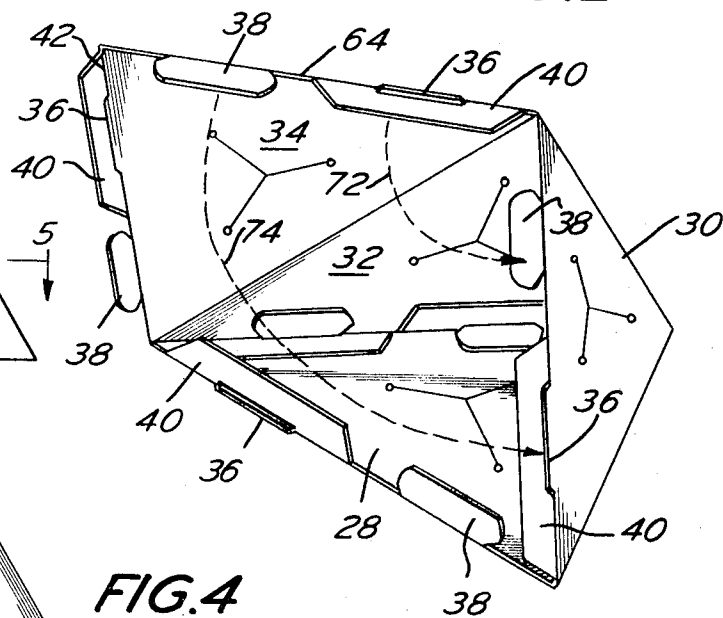
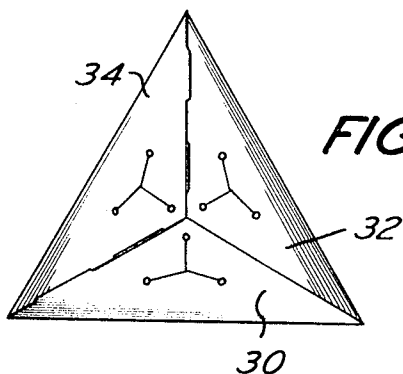


FIG. 4



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5 Sheets-Sheet 2

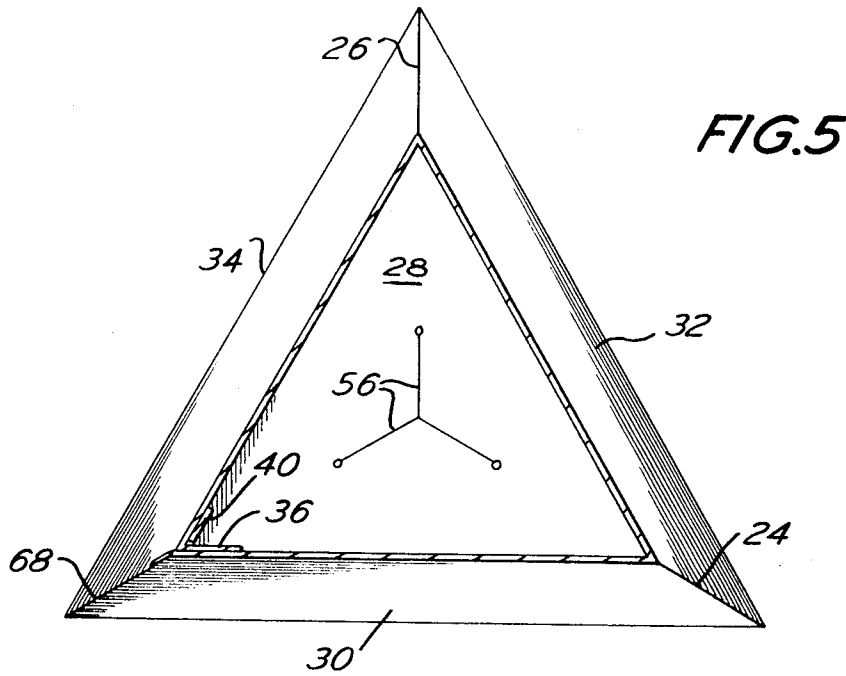


FIG. 5

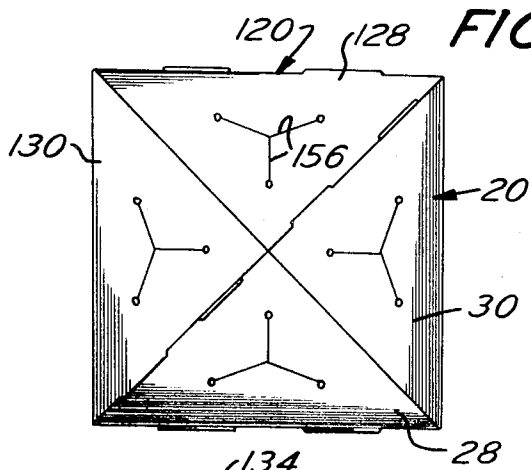


FIG. 7

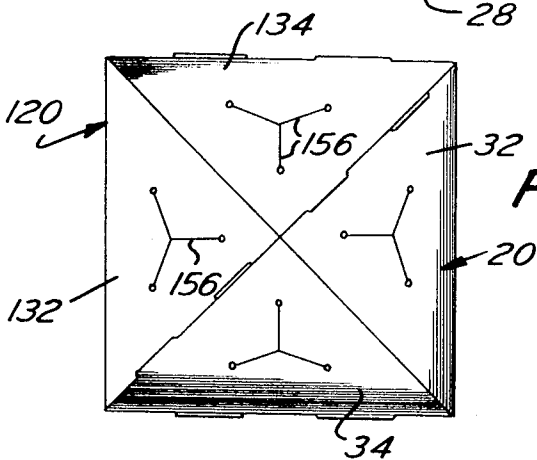


FIG. 8

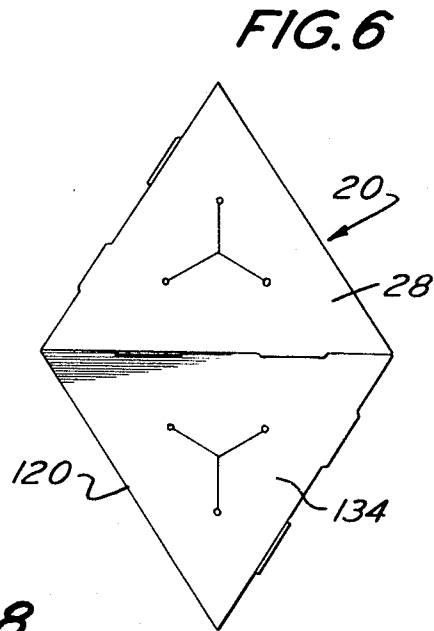


FIG. 6

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3,666,607

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5 Sheets-Sheet 3

FIG. 9

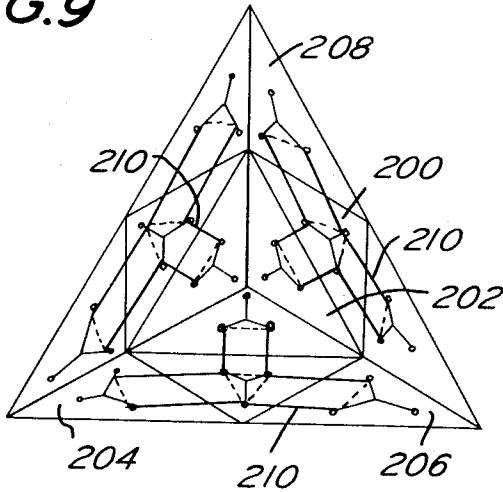


FIG. 11

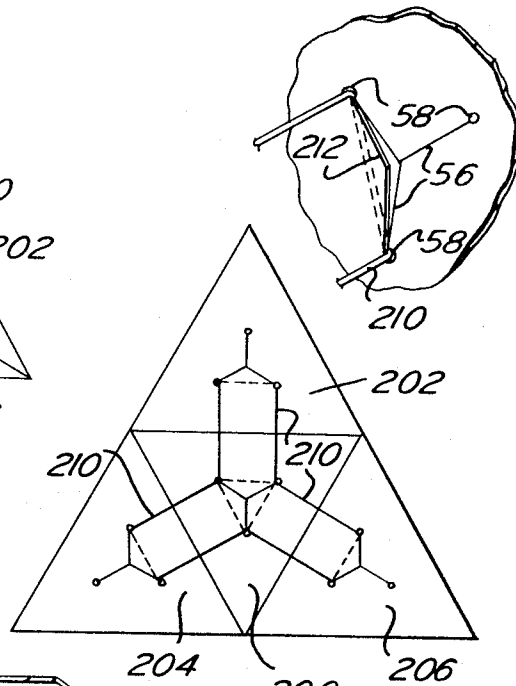


FIG. 14

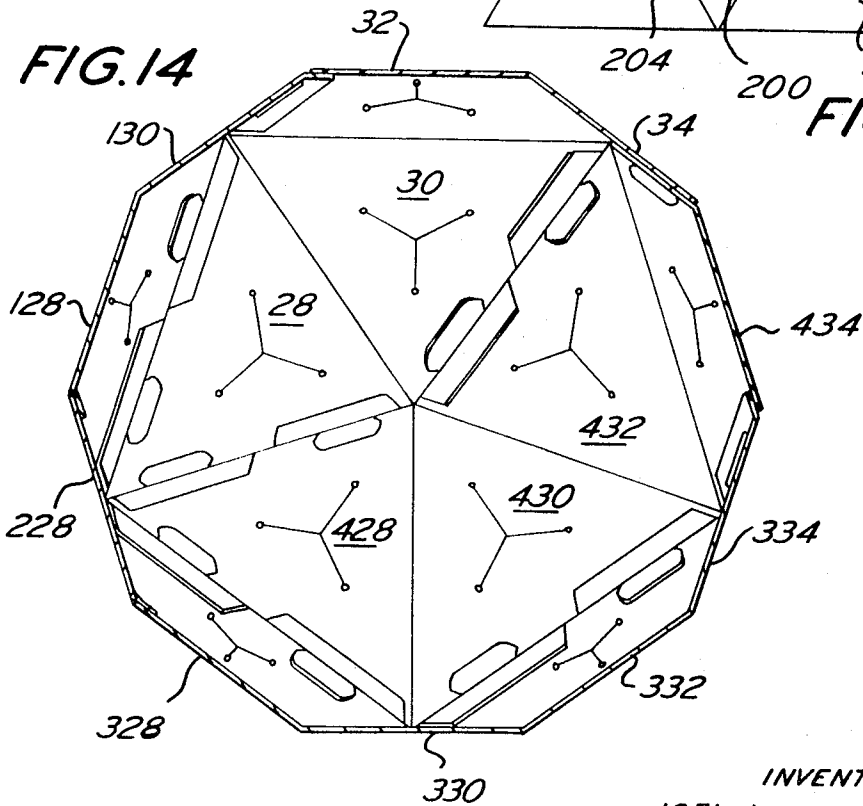


FIG. 10

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3,666,607

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5 Sheets-Sheet 4

FIG. 12

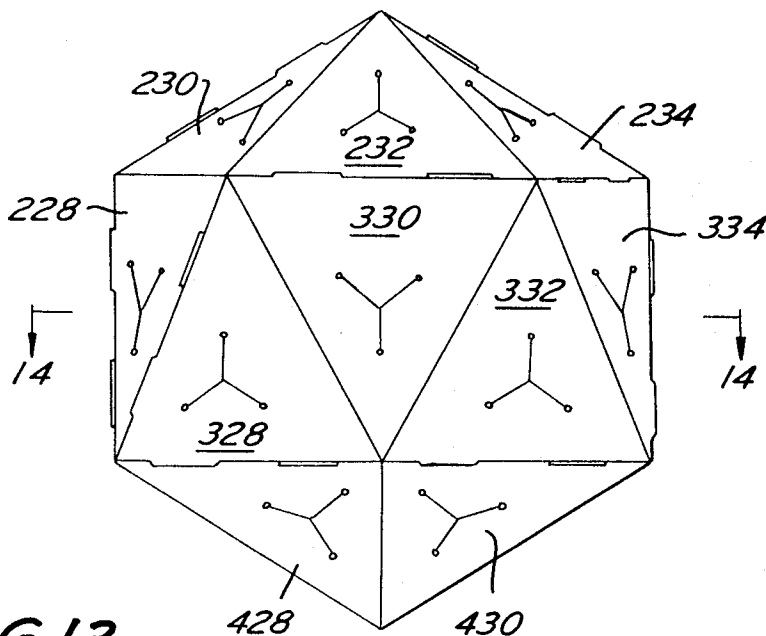
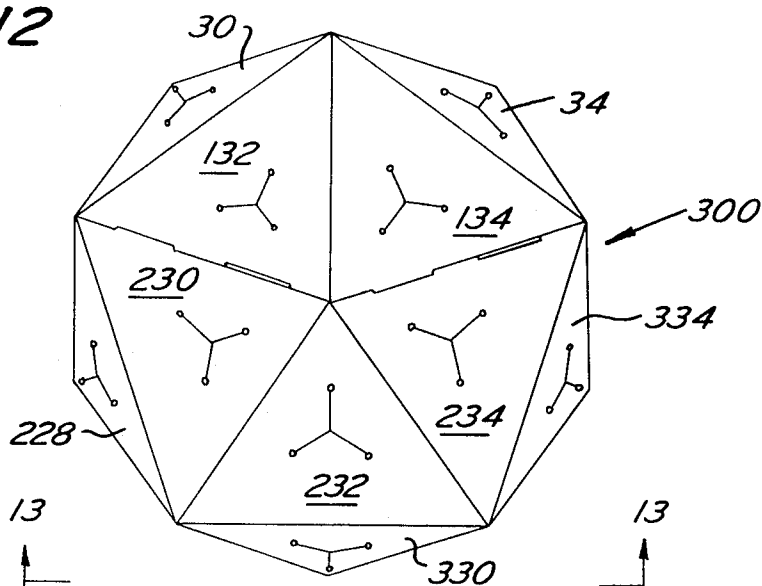


FIG. 13

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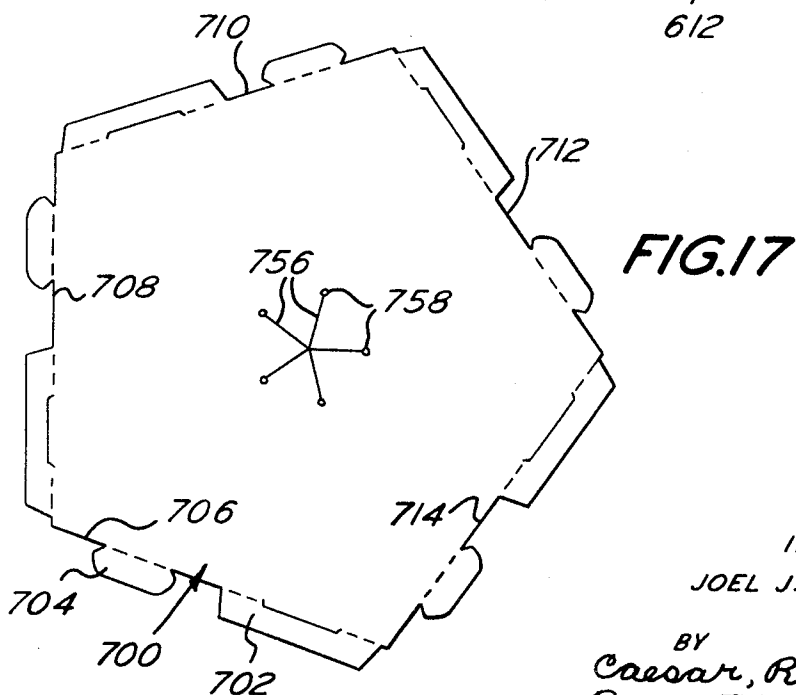
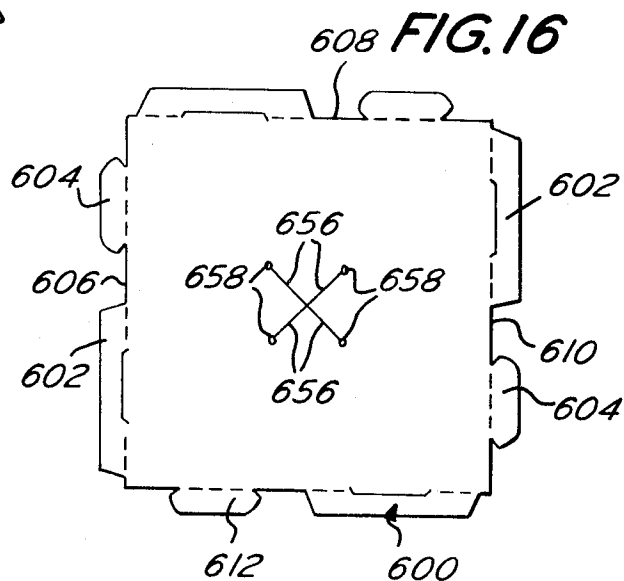
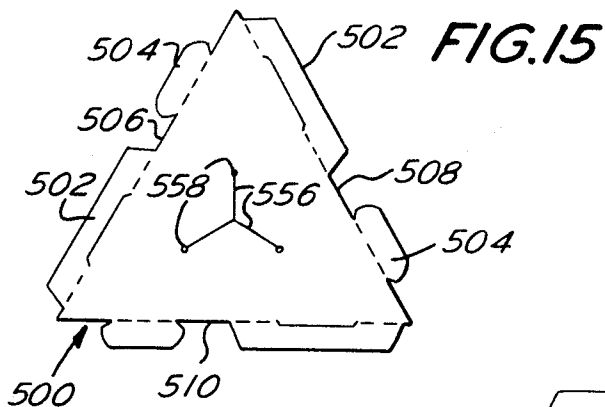
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5 Sheets-Sheet 5



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1

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BLANK FOR CONSTRUCTING SOLID FORMS

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U.S. Cl. 161-44

9 Claims

ABSTRACT OF THE DISCLOSURE

A blank for constructing solid forms. The blank comprises a stiff planar sheet. The sheet has at least one polygonally shaped section. Each of the sections has a plurality of slits in accordance with the number of corners of the polygon. Each of the slits emanates from the center of a polygonal section and extends outwardly towards one of the corners of the sections. The other ends of the slits are terminated at a circular opening. The blank has fastening elements on each of its free edges which are adapted to facilitate construction of a solid form. The slits enable the securement of the solid form to another solid form having polygonally shaped sections with similarly formed slits.

This invention relates generally to geometric solids and more particularly to a modular blank which facilitates construction of solid forms.

Heretofore existing blanks for constructing solid forms have various disadvantages.

The main disadvantage of prior blanks is that fastening elements for securing one blank to another or for making the individual blank into a solid by itself are inadequate. For example, a typical fastening element is the provision of a flap on the free edges of the blank. The flaps must then be adhesively secured to the surface of an opposing section adjacent the edge of the section having the flap. In order to adhesively secure these flaps to the opposing wall, it is necessary that the flap be exposed. The exposed flaps materially detract from the appearance of the geometric solids.

Another disadvantage is that where it is desired that the flaps be hidden, the flaps must be secured to the inner surfaces of the edges of the solid thereby making securement between the sides difficult as well as time consuming.

In another example of prior blanks, either a tab or a slot is provided on the edges of the blank. In order to secure a plurality of blanks together to form a solid, a complementary blank had to be provided in order to assure that a slot is opposite a tab. Thus, many geometric forms or solids could not be built with these blanks in that the tab and the slot arrangements on the sides precluded the same.

Another disadvantage of heretofore existing blanks is that after solids were formed, only external adhesives could be utilized to secure one solid form to another solid form to make a larger composite form. Thus, compositely shaped solids are also precluded from building with heretofore existing blanks.

It is therefore an object of the invention to overcome the aforementioned disadvantages.

Another object of the invention is to provide a new and improved blank for constructing solid forms which includes means for securing a first solid to a second solid.

Another object of the invention is to provide a new and improved blank for constructing solid forms having fastening elements about the blank which are hermaphroditic to facilitate construction of the solids.

2

Yet another object of the invention is to provide a new and improved blank for constructing solid forms, each of said blanks having polygonal sections, each section of which includes a plurality of slits which extend from the center thereof towards each of the corners of the sections which slits enable securement of one solid to another by use of rubber bands.

Still another object of the invention is to provide a new and improved blank for constructing solid forms having a plurality of edges, each of which includes one tab and one slot so that said blank may be secured to another blank having similarly formed fastening elements by inserting said tabs into said slots.

These and other objects of the invention are achieved by providing a blank for constructing solid forms. The blank comprises a stiff planar sheet. The sheet has at least one polygonally shaped section. Each of the sections has a plurality of slits in accordance with the number of corners of the polygon. Each of the slits emanates from the center of the polygonal section and extends outwardly towards one of the corners of the sections. The other ends of the slits are terminated at a circular opening. The blank has fastening elements on each of its free sides which are adapted to facilitate construction of a solid form. The slits enable the securement of one solid form to another solid form having polygonally shaped sections with similarly formed slits.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a top plan view of a blank embodying the invention;

FIG. 2 is a perspective view of the blank embodying the invention in an intermediate stage of construction of a tetrahedron;

FIG. 3 is a side elevational view of the tetrahedron formed from the blank embodying the invention;

FIG. 4 is a top plan view of the tetrahedron;

FIG. 5 is an enlarged sectional view taken along the line 5-5 in FIG. 3;

FIG. 6 is an octahedron built from two of the blanks embodying the invention;

FIG. 7 is a top plan view of the octahedron;

FIG. 8 is a bottom plan view of the octahedron;

FIG. 9 is a top plan view of an enlarged tetrahedron constructed from an octahedron and four tetrahedrons utilizing elastic bands to secure the individual forms together;

FIG. 10 is a side elevational view of the enlarged tetrahedron;

FIG. 11 is an enlarged area view of the securement means for the elastic bands;

FIG. 12 is a top plan view of an icosahedron constructed of five of the blanks embodying the invention;

FIG. 13 is a side elevational view of the icosahedron;

FIG. 14 is an enlarged sectional view taken along the line 14-14 in FIG. 13;

FIG. 15 is a top plan view of an alternate blank embodying the invention;

FIG. 16 is a top plan view of a second alternate blank embodying the invention; and

FIG. 17 is a top plan view of a third alternate blank embodying the invention.

Referring now in greater detail to the various figures of the drawing wherein similar reference characters refer to similar parts, a blank for constructing solid forms is shown generally at 20 in FIG. 1.

3

Blank 20 basically comprises a stiff planar sheet which is preferably made of stiff paper, cardboard, plastic or the like. Fold lines are formed in the blank by scoring the blank along the lines which are shown in phantom in FIG. 1. The blank 20 is generally in the shape of a parallelogram which includes three fold lines 22, 24 and 26 which divide the blank into four triangular sections 28, 30, 32 and 34 which are cascaded side to side. Each of the triangular sections 28 to 34 is adjacent to and is connected to another section along at least one of its edges. Sections 30 and 32, which are on the interior of the parallelogram, have two edges which are adjacent other sections of the blank 20 along the fold lines. Triangular sections 28 and 34 each have two of their edges along the free edges of the parallelogram.

Provided on each free edge of the sections of the blank 20, are hermaphroditic fastening elements comprised of a slot 36 and a tab 38. Slots 36 are formed on the blank by providing a flap 40 having fold lines 42 about a slit 44. Slit 44 is substantially parallel to lines 42 and includes inclined end portions 46 which extend from the slit 44 to the fold lines 42. A slot is thereby formed by bending the flaps about the fold lines 42 which causes a slotted opening in the flap 40 for reception of the tab 38.

Tabs 38 extend from and along the edges of the blank 20 at fold line 48. The forwardmost portions of the tabs 38 are arcuately tapered at edges 50 to facilitate insertion of a tab into a slot 36. The rearmost edges 52 of the tabs taper sharply inwardly to inhibit removal of the tab 38 from the slot 36. The width of the tabs 38 between edges 54 thereof is substantially equal to but slightly less than the length of slot 36. Therefore, when the tab is inserted in the slot, as the edges 54 of the tab 38 clear the opening in a slot 36, there is a slight snapping action. This enables the user of the same to readily determine when the fastening action is completed. The tight fit also prevents inadvertent loosening between the tab and the slot.

In each of the triangular sections 28 through 34, means for enabling securement of one solid formed of the blanks embodying the invention to another solid formed of similar blanks are provided. Each of the fastening means comprises a plurality of slits 56, each of which emanates from the center of the triangular section and extends towards one of the corners of the triangular section. Each of the slits is terminated in a circular opening 58.

The openings 58 serve two purposes. First, the openings prevent the slits 56 from becoming larger because of ripping when the securement means receive a rubber band. Second, the openings 58 can accommodate the cross-section of the rubber band without causing deformation of the slits. That is, when a rubber band is inserted in two slits, it rests in the openings 58 thereof and the area of a section between the slits returns to its normal position in the plane of the section.

As will hereinafter be seen in greater detail, the slits 56 enable a solid form constructed from blank 20 to be secured to a solid form constructed of similar blanks.

The blank 20 can be utilized either by itself to form a tetrahedron or with combinations of blanks to form other solid forms. For example, a tetrahedron is formed of a single blank 20 as shown in FIG. 2. To construct a solid form, the blank 20 should be folded along each of its fold lines prior thereto. That is, fold lines 22, 24, 26, 42 and 48 should each be folded in the same direction. That is, as seen in FIG. 2, each of the tabs 38 and the flaps 40 of the slots 36 should be folded downwardly with respect to the major portion of the blank. The sections 28 and 30 should be folded about fold line 22 with section 28 being urged downwardly as seen in FIG. 1. The section 34 should be folded about fold line 26 with section 34 being urged downwardly with respect to the remaining portion of the blank as shown in FIG. 1. Sections 30 and 32 should be folded about fold line 34 with

4

the fold line 24 remaining closest to the viewer in FIG. 1. The blank is then ready to be used for construction of a solid form.

To form a tetrahedron, the fastening elements of edge 60 of triangular section 28 are secured to the fastening elements of edge 62 of section 32. That is, tab 38 of section 28 is inserted into slot 36 of section 32 as tab 38 of section 32 is inserted into slot 36 of section 28. After the sections 28 and 32 are fastened together, the resulting structure is shown in FIG. 2. The fastening elements of edges 64 and 66 of section 34 are then secured to the fastening elements of edge 68 of section 30 and edge 70 of section 28, respectively, as indicated by arrows 72 and 74, which are shown in phantom in FIG. 2. It can therefore be seen that a tetrahedron is formed with a single blank 20. Construction of the tetrahedron is not only simple but also very quick. The hermaphroditic elements prevent non-alignment of fastening elements by assuring that any side of any blank having the same hermaphroditic elements have the correct fastening elements facing the fastening elements of the specific side. Thus, since each free edge of a section includes both a male and a female element, opposing edges of either the same or different blanks must be complementary and therefore mutually compatible with each other. Thus, many variations of securing one blank to another blank can be achieved.

Referring now to FIGS. 6 through 8, an octahedron is formed utilizing a pair of blanks 20. For ease of reference, the second blank is similarly numbered in the one hundreds. For example, sections 28, 30, 32 and 34 of the second blank are numbered 128, 130, 132 and 134, respectively.

Blanks 20 and 120 are prefolded along all of the scored fold lines prior to construction of the octahedron. In order to form the octahedron, the blanks 20 and 120 are secured together in the following manner:

The hermaphroditic fastening elements of edge 60 of section 28 are secured to the elements of edge 164 of section 134 of blank 120. The fastening elements of edge 62 of section 32 are then secured to the fastening elements of edge 166 of section 134. The fastening elements of edge 66 of section 34 are then secured to the fastening elements of edge 162 of section 132. The elements of edge 64 of section 34 are then secured to the elements of edge 160 of section 128. The elements of edge 68 of section 38 are secured to the fastening elements of edge 170 of section 128; and, finally the fastening elements of edge 70 of section 28 are secured to the elements of edge 168 of section 130.

The completed octahedron is seen in FIGS. 6, 7 and 8.

A large tetrahedron utilizing an octahedron formed as shown in FIGS. 6, 7 and 8 and four tetrahedrons as shown in FIGS. 2 through 5 is shown in FIGS. 9 and 10.

An octahedron 200 is secured to four tetrahedrons 202, 204, 206 and 208 by a plurality of rubber bands 210. As best seen in FIG. 11, the fastening means is comprised of slits 56 which are provided in each triangular section of the blanks which form the tetrahedrons and the octahedron are utilized to secure the ends of the rubber band.

Thus, as best seen in FIG. 11, one end of a rubber band 210 is secured to the fastening means by placing the end loop of the rubber band over the triangular projection 212 which is formed between the adjacent slits 56. The rubber band is then placed in openings 58 at the end of each of the two adjacent slits. When the rubber band 210 is secured in the openings 58, the triangular projection 212 returns to its normal position in the same plane as the remainder of the triangular section. Thus, the rubber band is secured at both ends in the securement means of the adjacent triangular sections of the tetrahedrons or the octahedron. It should be noted that the rubber bands may be replaced by other string or thread like securing means which can either be resilient or non-resilient.

5

Referring now to FIG. 9, it can be seen that tetrahedron 202 is secured adjacent one of the triangular sides of octahedron 200 by three rubber bands 210 which are secured in each of the fastening means on the exposed surfaces of the tetrahedron 202. The other ends of the three rubber bands are secured in the fastening means of the adjacent three sides of the octahedron. Similarly, the tetrahedrons 202, 204, 206 and 208 are similarly secured by three rubber bands to the three corner sides, as shown in FIGS. 9 and 10, of the tetrahedron 200.

Thus, it can be seen that the fastening means for the rubber bands comprised of the three slits 56 enables securement of three rubber bands extending in three different directions. The securement means also enables rubber bands to secure one solid to another solid. A large tetrahedron is thus formed by securing the four tetrahedrons formed by blanks 20 to octahedron 200 in that the sides of the tetrahedrons are parallel to the exposed surface of the octahedron.

In another example of the versatility of blank 20, five blanks 20 can be used to construct an icosahedron which is shown generally at 200 in FIGS. 12, 13 and 14.

For ease of reference, the third, fourth and fifth blanks are numbered in the two hundreds, three hundreds, and four hundreds, respectively. For example, the third, fourth and fifth blanks are thus numbered 220, 320 and 420.

In order to construct the icosahedron shown in FIGS. 12 through 14, each of the five blanks 20, 120, 220, 320 and 420 are folded along all of the fold lines as set forth above. Blank 20 is then secured to blank 120 by securing the hermaphroditic fastening elements of edges 60, 62 and 66 of blank 20 to the fastening elements of edges 170, 168 and 164, respectively, of blank 120. Blank 120 is secured to blank 220 by securing the fastening elements of edges 160, 162 and 166 to the fastening elements of edges 270, 268 and 264, respectively. Blank 320 is then secured to the blank 220 by securing the fastening elements of edges 370, 368 and 364 to the fastening elements of edges 260, 262 and 266, respectively. Blank 420 is then secured to blank 320 by securing the fastening elements of edges 470, 468 and 464 to the fastening elements of edges 360, 362 and 366, respectively. The other side of blank 420 is then secured to blank 20 by securing the fastening elements of edges 460, 462 and 466 to the fastening elements of edges 70, 68 and 64. The securement of the other side of blank 420 completes the construction of the icosahedron.

It can therefore be seen that the blank embodying the invention can be used either singularly or in conjunction with similar blanks to form various solid forms including geometric solids. Although only geometric solids have been shown in the specification, it should be understood that these blanks can be utilized to construct many solid forms other than those shown.

An alternate blank embodying the invention is shown at 500 in FIG. 15. Blank 500 basically comprises a single triangular section having hermaphroditic fastening elements 502 and 504 which are similar to fastening elements 36 and 38 of blank 20, on each of the three edges 506, 508 and 510. The hermaphroditic elements 502 and 504 are adapted to be usable in conjunction with blanks similar to blank 20. Blank 500 also includes fastening means comprised of slits 556 which emanate from the center of the triangularly shaped blank and extend towards each of the corners thereof and terminate at circular openings 558.

Blank 500 can be used together with a plurality of similar blanks as well as with blank 20. Thus, solid forms having an odd number of sides or a number of sides not divisible by four can be formed by fastening the blank 500 in conjunction with other blanks having similar fastening elements on the edges. It should be noted that the length of edges 506, 508 and 510 are equal to edges 60 through 70 of the blanks 20. The provision of the fastening means comprising slits 556 also enables the solid

6

forms constructed with blank 500 to be connected to other solid forms by means of rubber bands as hereinbefore illustrated.

A second alternate embodiment embodying the invention is shown generally at 600 in FIG. 16. Blank 600 is square and includes hermaphroditic fastening elements 602 and 604 on each of its four edges 606, 608, 610 and 612. The hermaphroditic fastening elements are identical to those utilized on each of the edges of blank 20 and are therefore compatible with the same for connection thereto. The fastening means comprises four slits 656 which emanate from the center of the blank and extend towards each of the corners of the square blank 600 and terminate at circular openings 65. Each of the edges of the blank 600 are equal in length to the edges 60 through 70 of blank 20. The blank 600 can also be used with blank 500 as well as blanks similar to blank 600.

A third alternate blank embodying the invention is shown at 700 in FIG. 17. Blank 700 includes hermaphroditic fastening elements 702 and 704 along each of its edges 706 through 714. The blank 700 is pentagonally shaped and includes fastening means comprised of five slits 756 which emanate from the center of the blank and each extends towards one of the corners of the blank and terminates in a circular opening 758. The hermaphroditic elements 702 and 704 are identical to the fastening elements of blank 20 and each of the edges 706 through 714 are also the same length as edges 60 through 70 of blank 20. Therefore, blank 700 is compatible with all of the aforementioned modules and may be used in conjunction with other identical modules when constructing solid forms.

It can therefore be seen that a new and improved blank for constructing solid forms has been provided. The various embodiments of the blank each include a plurality of slits which emanate from the center of the individual sections of the blank and extend towards each of the corners. Thus, where triangular sections are utilized, three slits are provided which extend towards each of the corners. Where a square section is utilized, four slits are provided which extend towards each of the corners. In the pentagonal embodiment, five slits are provided, each extending towards the corners of the pentagon. The fastening means enables a plurality of discrete solid forms to be secured together with only rubber bands or other suitable fastening members.

The hermaphroditic fastening elements provided on each edge facilitates securement of one blank to another blank. Geometric solids as well as various other shapes may be formed utilizing combinations of the blanks hereinbefore described. It should be understood that the blanks shown herein are only exemplary of the various blanks that can be formed utilizing the invention embodied herein. For examples, may be formed having two or more of the triangular, rectangular or pentagonal sections. Hexagonal sections may also be utilized. The hexagonal section would of course utilize six slits for the fastening means provided at the center of the section with each of the slits extending towards a different one of the corners of the hexagon and terminating in a circular opening. Where a plurality of sections is utilized on a single blank, the adjoining sections should be connected at a fold line and each of the free edges of the blank should include hermaphroditic fastening elements similar to those shown in the remaining drawings.

Without further elaboration, the foregoing will so fully illustrate my invention that others may, by applying current or future knowledge, readily adapt the same for use under various conditions of service.

What is claimed as the invention is:

1. A blank for constructing solid forms, said blank comprising a stiff planar sheet, said sheet having at least one polygonally shaped section, each of said sections have a plurality of slits in accordance with the number of corners of said polygon, each of said slits emanates from

7

the center of a polygonal section and extends outwardly towards one of said corners of said section, said blank having fastening elements on each of its free sides adapted to facilitate construction of a solid form, said slits enabling the securement of said solid form to another solid form having polygonally shaped sections with similarly formed slits.

2. The invention of claim 1 wherein the end of said slits which are closest said corners are terminated at a circular opening.

3. The invention of claim 1 wherein a plurality of said polygonal sections are provided on said sheet, said sections being cascaded side to side and connected together at fold lines, said fold lines facilitating construction of solid forms from said blank.

4. The invention of claim 3 wherein said fastening elements are hermaphroditic and are comprised of a tab and a slot.

5. A blank for construction solid forms, said blank comprising a planar sheet having a plurality of polygonal sections which are defined by at least one score line which is common to one edge of each of a pair of adjacent sections and the periphery of said blank, each of said sections having at least one of its edges at the periphery of said blank, each of said edges of said sections at the periphery of said blank having hermaphroditic fastening elements each comprised of a tab and a slot, said tab having a smoothly tapered forward portion and a sharply tapered base portion so that said tabs may be inserted easily into said slots but are difficult to remove, said blank adapted to be folded along said score lines, said fastening elements adapted to secure the edges of one section of said blank to similarly formed edges of a section of either the same blank or another blank to enable construction of solid forms.

6. The invention of claim 5 wherein said blank comprises four triangular sections which are defined by three score lines.

7. The invention of claim 5 wherein said sections are connected together side by side so that by folding said blank along said score lines and securing suitable ones

8

of said edges together, said blank enables construction of a tetrahedron.

8. The invention of claim 5 wherein each of said sections includes a plurality of slits, each of said slits emanating from the center of a polygonal section and extending outwardly towards one of said corners of said sections and terminating at its other end in a circular opening, said slits enabling fastening of one solid form constructed from at least one of said blanks to another solid form constructed from at least one of said blanks.

9. A blank for constructing solid forms, said blank comprising a stiff planar sheet, said sheet having at least one polygonally shaped section, said blank having hermaphroditic fastening elements each comprised of a tab and a slot on each of its free sides adapted to facilitate construction of a solid form, said tab having a smoothly tapered forward portion and a sharply tapered base portion so that said tabs may be inserted easily into said slots but are difficult to remove, said fastening elements adapted to secure the edges of one section of said blank to similarly formed edges of a section of either the same blank or another blank to enable the construction of solid forms.

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J. C. GIL, Assistant Examiner

U.S. Cl. X.R.

93—1.1; 161—7, 13, 14, 16, 17, 109, 112; 229—22