Nov. 3, 1959 J. C. A. MacMILLAN 2,910,737

STRUCTURAL TOY

Filed June 28, 1957

FIG. 1.

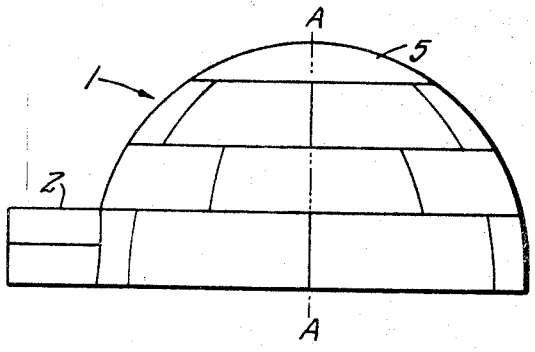


FIG. 4a.

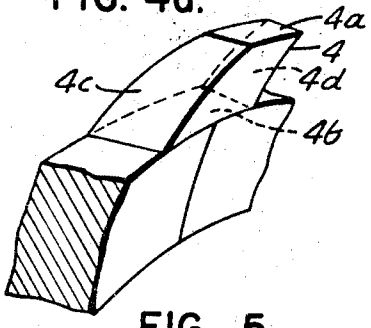


FIG. 5.

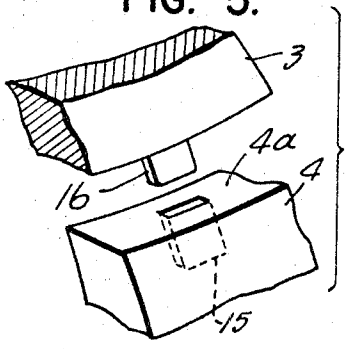


FIG. 2.

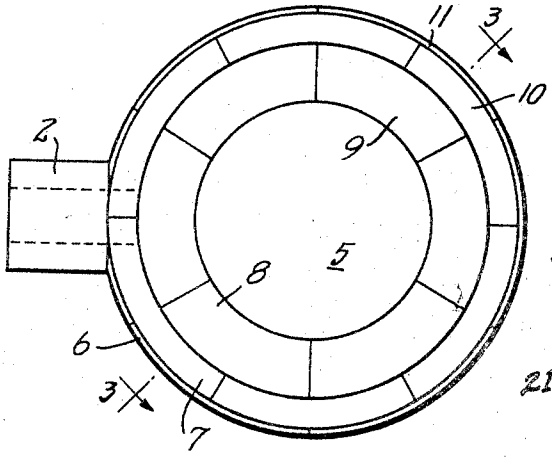


FIG. 6.

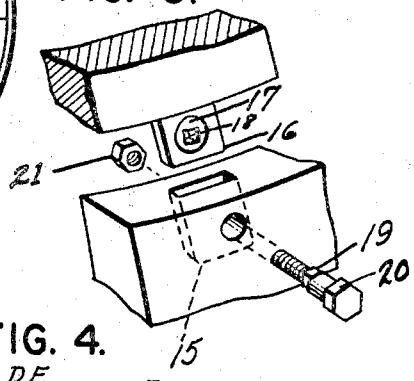


FIG. 3.

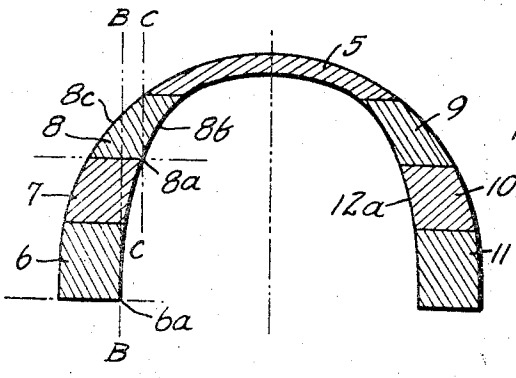
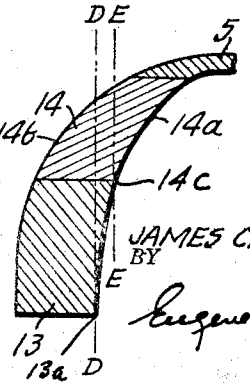


FIG. 4.



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STRUCTURAL TOY

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5 Claims. (Cl. 20—1)

The present invention relates to a structural dome-like toy corprising three dimensionally curved segments and in particular to a toy igloo and similar structures.

Construction toys generally comprise rectangular configurated blocks from which building structures are then produced. However, in the general toy field not much has been done with the construction of dome-like structures from three dimensionally curved building block segments. Apparently the reason for this is because it is difficult to produce such segments or elements economically which can then be fitted together to produce a dome-like structure. Such segments would have to be curved in three dimensions and would have to be made sufficiently accurate so that the parts can be fitted together easily by children. In addition, each of the curved segments should be structurally stable so as to enable them to be seated in position one on top of the other without toppling over, particularly near the top of the dome where there is a substantial overhang of the inner surface due to the internal curvature of the inner wall of the dome.

It is the object of the present invention to provide a plurality of three-dimensionally curved, structurally stable building block segments from which dome-like toy structures can be produced.

Another object is to provide a toy igloo comprising a plurality of fittable, three-dimensional curved building blocks characterized in that the curved segments are configurated so that each is structurally stable alone or in combination with each other.

These and other objects will more clearly appear when taken in conjunction with the following description and the accompanying drawings wherein:

Figs. 1 and 2 show the elevation and top views, respectively of an igloo-shaped structure produced from three-dimensionally curved segments;

Fig. 3 is a cross-section of the igloo taken along line 3—3 of Fig. 2 as viewed in the direction of the arrows showing three layers of building block segments topped by a spherically shaped cap;

Fig. 4 is similar to Fig. 3 and shows a partial cross-section illustrating two layers of building block segments similarly topped by a cap;

Fig. 4*a* shows how the curved building block segments illustrated in cross-section in Fig. 4 appear in three dimensions;

Fig. 5 is illustrative of connecting means which may be employed to fit various curved segments together in producing a unitary dome; and

Fig. 6 shows how the connecting means illustrated in Fig. 5 can be used in combination with a cam bolt to effect a rigidly constructed dome.

Referring to the drawing, Figs. 1 and 2 show one embodiment of a toy igloo produced in accordance with the invention comprising a dome-like portion referred to generally as 1, and an entrance portion 2. The dome-like portion 1 is made up of a plurality of three dimensionally curved segments such as segments 3 and 4 which are shown in Fig. 5. The segments are characterized by top and bottom portions 4*a* and 4*b* as shown in Fig. 4*a*. The top and bottom portions are referred to broadly as flat supportable surface portions of curvilinear contour, the flat surface lying in a plane which passes transversely through and, preferably, substantially perpendicular to the polar axis of the dome-like structure produced when the curved segments are assembled together. The curved segments are also characterized by flat side portions 4*c* and 4*d* as shown in Fig. 4*a*, the flat side edges also being of curvilinear contour, the flat side surface lying in radial planes which preferably contain the polar axis of said dome-like structure. The polar axis referred to would be the axis A—A as shown in Fig. 1 of the dome-like igloo. When the curved segments are configurated as described above by molding, they are easily assembled together side by side and one on top of another to form an accurately assembled dome-like structure. The top of the dome may comprise a cap 5 as shown in Fig. 1, or triangular curved segments fitted together to form a cap.

It is important that the three dimensionally curved building blocks be structurally stable, that is be capable of standing up either alone or one on top of the other without falling over. To achieve this stability, the curved blocks, at least those above the first row forming the base of the igloo, should be so configurated in cross-section that the center of gravity of the block is maintained well within the block itself. This essential feature of the invention will more clearly appear from the cross-section of the igloo shown in Figs. 3 and 4. In Fig. 3, curved blocks 6, 7, 8, 9, 10, 11, either alone or in cooperative relation, are stable and will maintain the dome shape without falling over. Block 8 which has the greatest overhang (note inner curved surface 8*b*) is tapered in cross section (by convergence of curved outer surface 8*c* to inner curved surface 8*b*) so that the center of gravity of the block is maintained well within its cross section, that is to the left of inner bearing or fulcrum edge 8*a* of the base of the block. By drawing dot and dash line C—C perpendicular to the base of the block through 8*a*, it will be noted by inspection that a substantial portion of the cross-sectional area of the block is to the left of this line, thereby insuring structural stability. Likewise, the three curved blocks 6, 7 and 8, taken together as a unit, must be stable relative to fulcrum edge 6*a*. Thus, by inspection it will be noted that taking together the total cross sectional area of blocks 6, 7 and 8, a good portion of this area lies to the left of line B—B passing through fulcrum edge 6*a*. The same is true of elements 9, 10 and 11. In other words, it is important for structural stability that the inner and outer curved wall surfaces of the dome, such as 12*a* and 12*b*, should taper or converge one towards the other so that the center of gravity should be well within the wall mass of the block, interior of its inner fulcrum edge. By inner fulcrum edge is meant such edges as 8*a*, 6*a*, etc. about which the block or group of assembled blocks would topple if the center of gravity of the section is to one side of the edge in the direction of the dome axis.

Fig. 4 is similar to Fig. 3 with the exception that only two horizontal rows of curved blocks are used to form the major portion of the dome structure before topping the two rows with polar cap 5. Thus, it will be noted with respect to block 14 that outer curved surface 14*b* and inner curved surface 14*a* substantially converge towards one another. Yet, despite the substantial overhang of curved surface 14*a*, the block is structurally stable as shown by the larger amount of cross-sectional area to the left of line E—E passing through fulcrum edge 14*c*. Likewise, the two blocks taken together are

structurally stable as shown by the amount of cross sectional area to the left of the line D—D passing through fulcrum edge 13*a*.

The foregoing feature makes the curved building blocks easily manipulatable by a child and once the toy dome or igloo is constructed it also retains its structure by the wedging and keying action of the blocks whose sides, e.g. 4*c* and 4*d*, lie in radial planes which preferably contain the polar axis of the dome. Thus, the blocks need merely be piled one on top of the other as in Fig. 4*a*, the shape of the block determining its relative position in the dome.

If a rigid structure is desired capable of withstanding vibrational disturbance within its immediate environment, connecting means may be utilized between adjacent coinciding flat surface portions of the segments. This is illustrated with particularity in Figs. 5 and 6 of the drawing. Fig. 5 shows a bottom curved segment 4 having a recess 15 which is directly below a connecting means or dowel 16 projecting downwardly from curved segment 3.

In Fig. 6, a similar structure is shown with the exception that recess 15 has a hole passing through it from the outside, the hole lining up with the hole in dowel 16. The hole has a revolving cam 17 therein with an offset square hole 18 adapted to receive square bolt portion 19 of bolt 20. Thus the bolt is passed through dowel 16 and turned to revolve offset cam 17 downward so as to urge the dowel down in tight fitting relationship with recess 15. Recess 15 must be large enough in width to give dowel 16 enough sidewise or lateral play during the camming action of the bolt. The bolt is then secured by nut 21 to effect a rigid structure.

The curved segments may be made from a molding mixture or from a plastic composition. Each layer of curved building elements forming the igloo may be made from equal sized elements. For example, looking at the top view of Fig. 2, it will be noted that the curved segments forming each layer are of equal size being cut in 60° sectors. Referring to Fig. 4, element 13 being all the same size and divisible into 360° would fit together to form a circular wall. Likewise, element 14 would similarly fit together. Since the elements in each layer would be the same size, then one mold would be required to make elements 13 and one mold to make elements 14. A molding mixture would be poured into the mold and shaped to the mold contour and after the material has solidified, the formed element is then removed. Polar cap 5 would be made similarly in another mold.

The elements of the dome could all be made simultaneously in a flexible compartmented rubber mold such as described in my copending application U.S. Ser. No. 601,389, filed August 1, 1956. The entrance portion 2 of the igloo would be made in a separate mold. The entrance may be made as a unitary structure or may comprise several pieces of two side wall portions supporting an archway portion. In making the entrance, the part contacting the igloo, e.g. 2*a*, should coincide substantially with the curvature of the dome. An opening would run through one of the building segments at the base of the igloo where the entrance portion abuts it. This element with the opening would be produced in a separate mold similar to the production of the other elements.

The present invention is also adaptable to three-dimensional puzzles. In this connection, the invention can be adapted to the making of a world relief map in the form of a hemispherical globe. Or, if a dome-like building is desired showing reliefs of windows, doors and the like, the interior mold surface can be reliefed with such surface configurations. Even three dimensional picture puzzles can be made in the same way, that is with the pictures imprinted by molding on the curved surface of the dome. Such puzzles would have a considerable educational value for children.

While the present invention has been described with respect to a toy igloo, it will be appreciated that the inventive concept is also applicable to the production of large inhabitable dome-like structures.

While the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention and the appended claims.

I claim:

1. A set of building blocks for the production of a hollow dome-like structure which comprises a polar cap and a plurality of three-dimensionally curved segments characterized by upright stability, a group of said segments adapted to form a first row constituting the base of said structure, another group of said segments adapted to form at least one row superposed on top of the first row, each of said building segments having inner and outer curved surfaces and having a pair of flat surface portions transverse to said curved surfaces each lying in a plane substantially parallel to each other, each of said planes passing transversely through and substantially perpendicular to the polar axis of said dome-like structure produced from said segments, each segment also having flat side edges transverse to said curved surfaces and which lie in radial planes which contain the polar axis of said dome-like structure produced therefrom, the thickness of each of said three-dimensionally curved segments varying as a curved taper in the upwardly direction by virtue of the inner and outer curved surfaces converging towards each other, the curved taper being such that in radial cross section the center of gravity of each segment is to one side of an inner fulcrum supporting edge and well within the segment towards the outer surface thereof, the relation of the curved taper of an underlying segment with that of one or more segments superposed thereabove being such that taken as a whole the superposed segments including the underlying segment forming the base of the structure have a combined center of gravity well within the radial cross section of the segments combined whereby they have upright stability relative to the surface supporting the dome-like structure formed from all of the segments.

2. The set of building blocks as defined in claim 1 wherein the three dimensionally curved segments have fitting means adapted to connect one block to the other to form a rigid structure.

3. A dismantable toy igloo of a hollow dome-like configuration comprising a polar cap on top of a stacked arrangement of a plurality of three-dimensionally curved segments characterized by upright stability, a group of said segments forming a first row constituting the base of said igloo, another group of said segments forming at least one row superposed on top of the first row, each of said building segments having inner and outer curved surfaces and having a pair of flat surface portions transverse to said curved surfaces each lying in a plane substantially parallel to each other, each of said planes passing transversely through and substantially perpendicular to the polar axis of said igloo, each segment also having flat side edges transverse to said curved surfaces and which lie in radial planes which contain the polar axis of said igloo produced therefrom, the thickness of each of said three-dimensionally curved segments varying as a curved taper in the upwardly direction by virtue of the inner and outer curved surfaces converging towards each other, the curved taper being such that in radial cross section the center of gravity of each segment is to one side of an inner fulcrum supporting edge and well within the segment towards the outer surface thereof, the relation of the curved taper of an underlying segment with that of one or more segments superposed thereabove be-

ing such that taken as a whole the superposed segments including the underlying segment forming the base of the structure have a combined center of gravity well within the radial cross section of the segments combined whereby they have upright stability relative to the surface supporting the igloo.

4. The igloo of claim 3 wherein the three-dimensionally curved segments have fitting means adapted to connect one block to the other to form a rigid structure.

5. The igloo of claim 3 wherein at least one of the segments forming at the base thereof has passageway means associated therewith.

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