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(54) **MAGNETIC PANEL SYSTEM**

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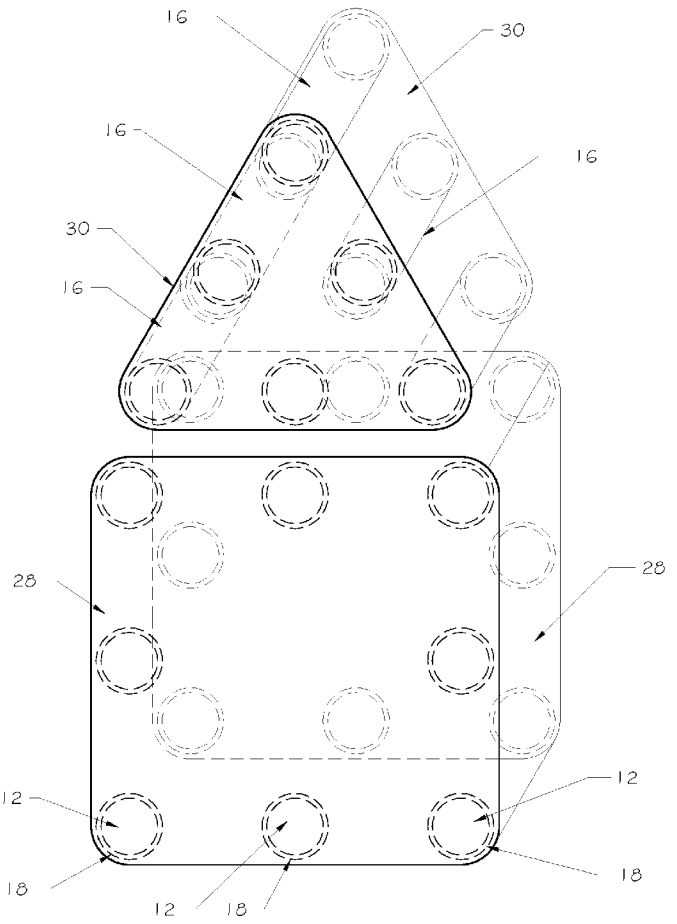
(57) **ABSTRACT**

A magnetic panel system for the construction of structures includes sets of polygonal panel bodies, preferably constructed using plastic or other suitable material, that have corners, edges, and endpoints of rods that are substantially rounded to conform to the accommodation of a plurality of hollow spherical sockets around the perimeter of the polygonal bodies, containing spherical magnets. Although spherical magnets are localized with a clearance in said hollow spherical sockets, they are free to rotate within due to external magnetic fields produced by magnets in other similarly constructed bodies. Free rotation of spherical magnets assures alignment of magnet fields and universal mutual attraction of adjacent bodies in a multitude of configurations including face-to-face, edge-to-edge, and corner-to-corner combinations. Equal spacing of sockets in bodies assures magnets are in consistent proximity to other magnets in adjacent bodies.



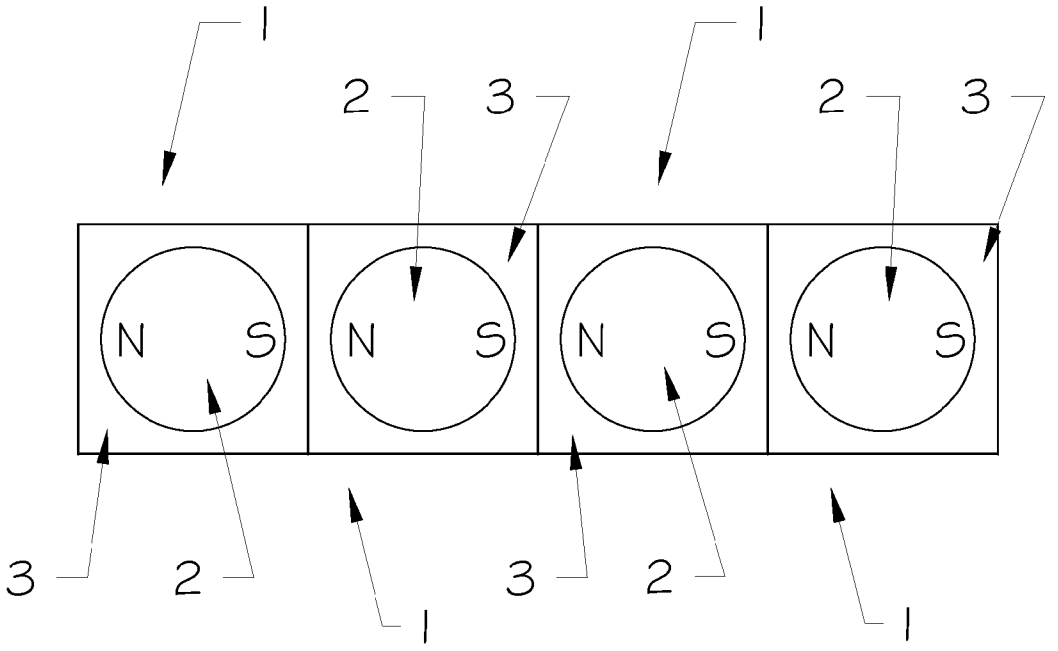


FIG. 1

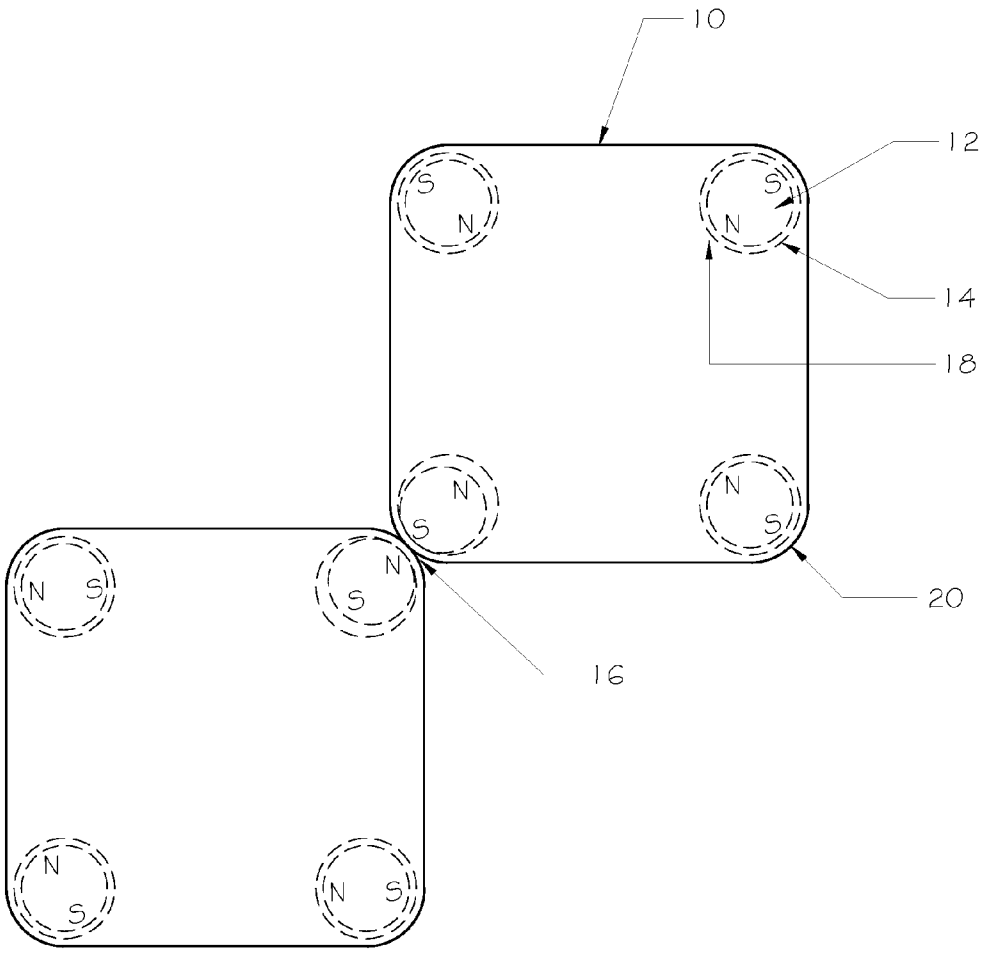


FIG. 2

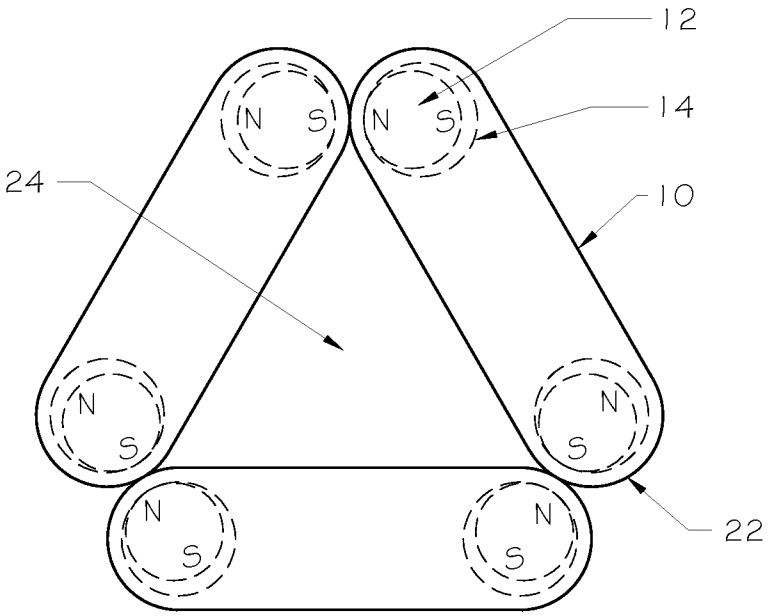


FIG. 3

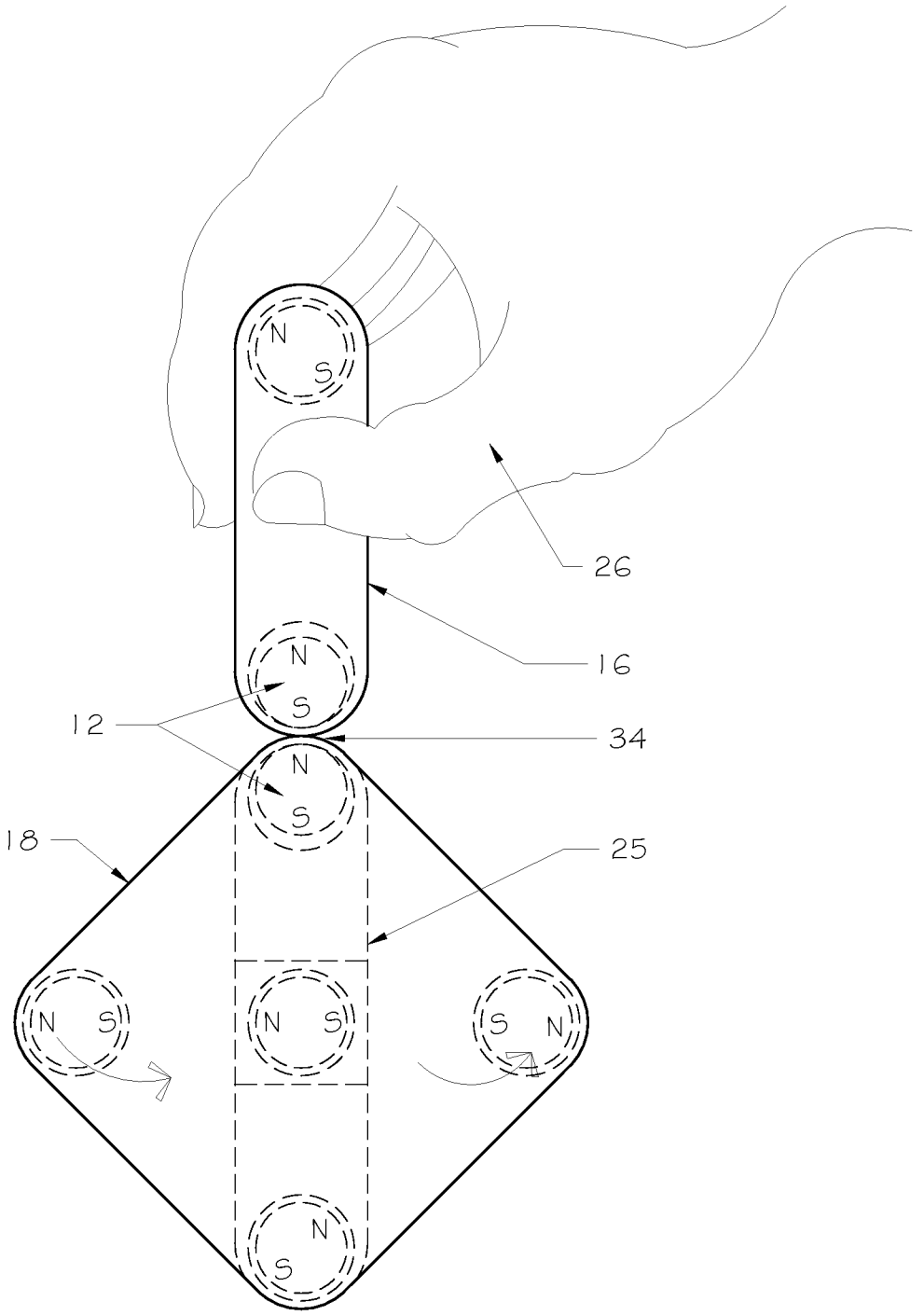


FIG. 4

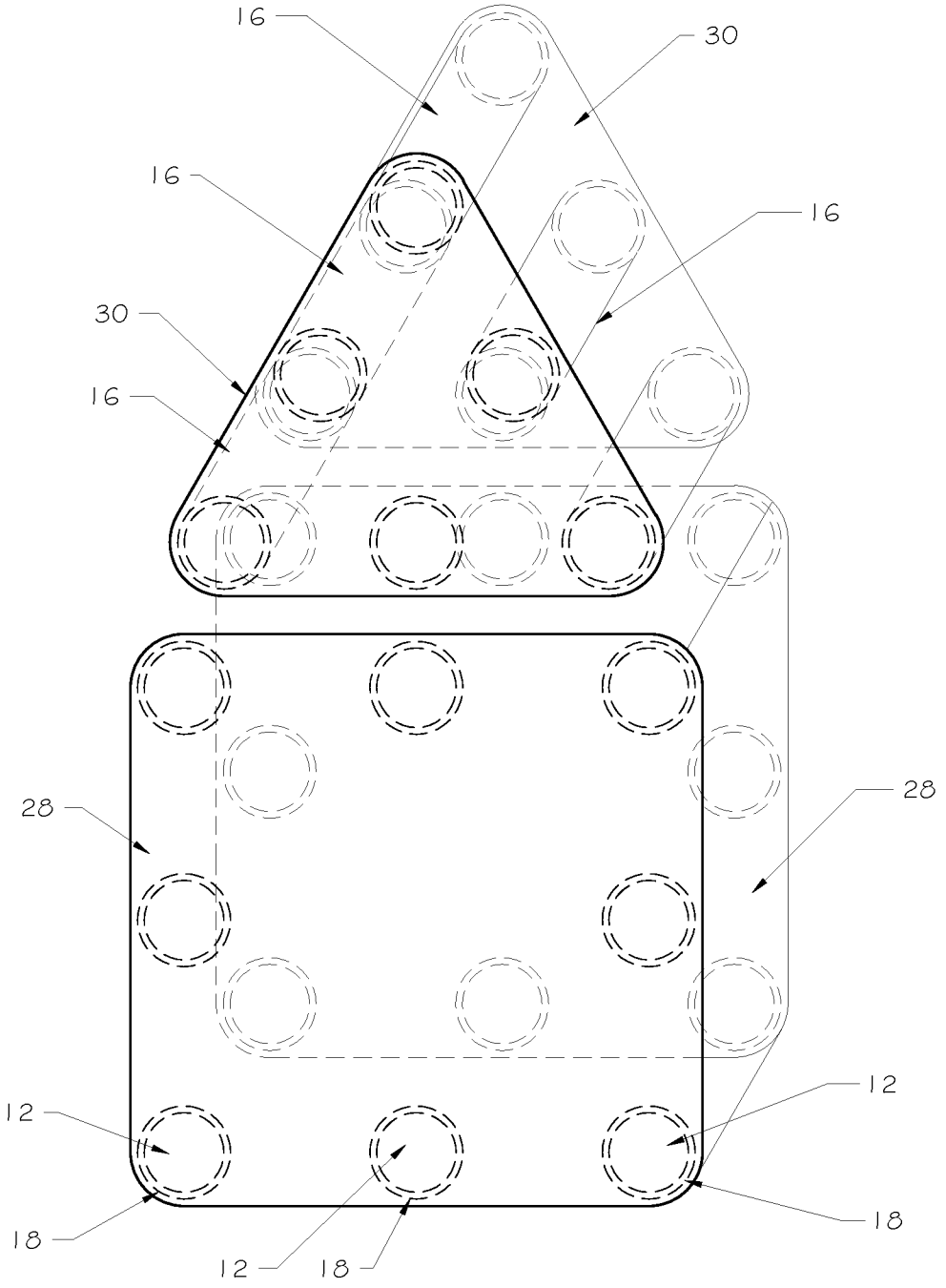


FIG.5

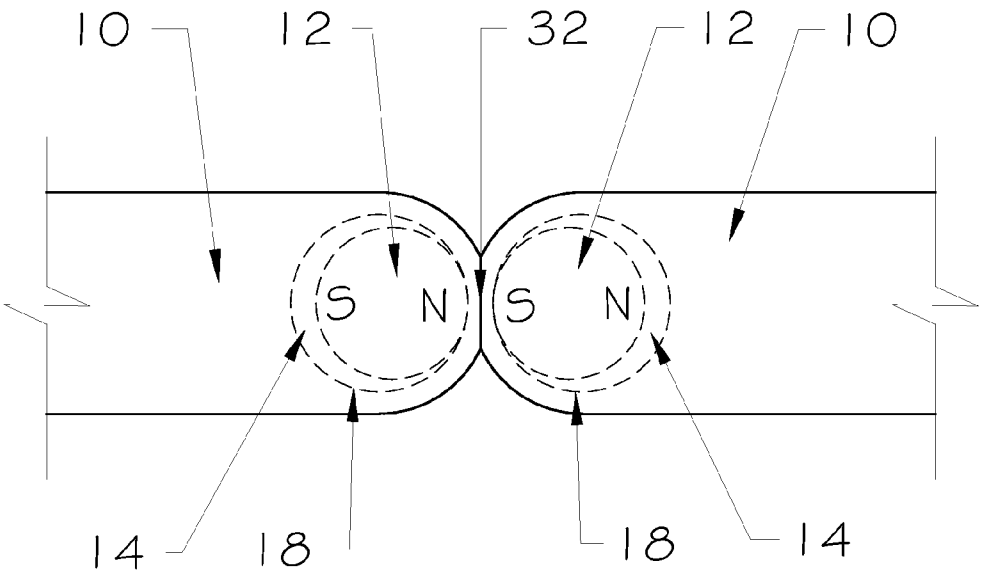


FIG. 6

MAGNETIC PANEL SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims benefit under 35 U.S.C. 119 (e) of the prior filing of U.S. Provisional Application, Ser. No. 61/848,423 filed the third day of January 2013 by the present inventor.

BACKGROUND OF THE DISCLOSURE

[0002] 1. Field of the Disclosure

[0003] This disclosure relates to magnetic construction toys.

[0004] 2. Background

[0005] Toy retail stores commonly sell magnetic construction sets that allow children to build various forms and structures. A conventional design is well illustrated by Vincentelli (EP 1349626 B1). Vincentelli shows magnetic rods, covered in plastic that have cylinder-shaped magnets fixed on each end. Ferromagnetic spheres are provided for the attachment of the magnetic rods. By coupling a plurality of magnetic rods to ferromagnetic spheres a desired model or structure is achieved. Said conventional magnetic construction toy suffers from several deficiencies. One is that the structures have low structural strength due to the shifting of angles between adjacent magnetic rods combined with the weight of said ferromagnetic spheres. In compensation for said deficiency, plastic panels are frequently inserted in the void between said magnetic rods and ferromagnetic spheres to supply added support to the desired structure. Another deficiency of said conventional magnetic construction toy is the excessively large number of rods, panels and metal spheres needed to construct a desired structure, requiring excessive time, complexity and effort to construct a desired structure.

[0006] Bong-Seok Yoon (U.S. Pat. No. 7,160,170) shows polygonal bodies incorporating magnets loosely contained in compartments. Said bodies are then anchored together due to the mutual attraction of magnets in adjacent panels. Although Yoon's design requires few pieces to assemble a desired structure, it also suffers from many deficiencies. Within Yoon's given polygonal body, loose magnets in adjacent compartments can exert mutual attractive forces and prevent magnets from anchoring onto a desired adjacent panel. Also, said compartments reduce the structural strength of said panel resulting in potential breakage if said panel if accidentally stepped on.

[0007] Additionally, said loosely held magnets can rattle in compartments creating unwanted noise. Also, having loosely contained magnets inhibits the ability to evenly align adjacent panels, a necessary condition for accurate construction of structures.

[0008] Ogikubo (U.S. Pat. No. 5,347,253) provides a connector body arranged to contain a spherical magnet rotatably within its interior, for substantial universal rotation of the magnet for orientation of the opposite, north and south poles of the magnet as needed for proper magnetic attraction to a corresponding magnet of a second body member. While this connector magnet structure may be well suited for the face surfaces forming the side walls of multi-sided cube-type or block-type magnetic connector bodies to be joined together in face-to-face condition, it does not provide satisfactory magnetic connector structures capable of or arranged for magnetic connection of multiple magnetic connector bodies in edge-to-edge or corner-to-corner condition along mutually confronting, peripheral edges or corners of the connector bodies due to the relatively large distance between said spherical magnets when employed in edge-to-edge or corner-to-corner condition.

[0009] Hunts (U.S. Pat. No. 7,154,363) shows a magnetic connector apparatus providing a plurality of magnetic connector bodies in various different forms for magnetic connection of two or more bodies together along mutually-confronting, longitudinally-elongated, linear peripheral border edges utilizing longitudinally elongated, diametrically magnetized cylinder magnets. While this connector magnet structure may be well suited for edge-to-edge connection of connector bodies, it fails to provide corner-to-corner connection which is necessary for bodies that require free rotation such as rods and axels. Axels can be incorporated into structures to provide a greater variety in forms, and can be used in conjunction with wheels and gears, which are desired in children's construction sets. Also, said connection apparatus utilizing cylinder magnets fails to provide universal attachment for end-points of rod-like structures that are also desired in children's play sets.

SUMMARY OF THE PRESENT DISCLOSURE

[0010] The present disclosure has been made keeping in mind the above problems occurring in the prior art. An object of the present disclosure is to provide sets of polygonal panel bodies, preferably constructed using plastic or other suitable material, that have corners, edges and endpoints of rods that are substantially rounded to conform to the accommodation of a plurality of hollow spherical sockets around the perimeter of said bodies. Although spherical magnets are localized in said hollow spherical sockets they are free to rotate within due to external magnetic fields produced by magnets in other similarly constructed bodies. Free rotation of spherical magnets assures alignment of magnet fields and universal mutual attraction of adjacent bodies in a multitude of configurations including face-to-face, edge-to-edge and corner-to-corner combinations. Equal spacing of sockets in bodies assures magnets are in consistent proximity to other magnets in adjacent bodies and alignment of body edges and corners improves ease of construction of desired structures, which may include, but is not limited to, children's play houses. In addition, said equal spacing allows quick and uniform stacking of sets of said polygonal panel bodies for purposes of efficient packaging, shipping and storage, which is convenient for both retailers and consumers.

[0011] Another object and advantage of this disclosure is the provision of spherical magnets in hemispherically-rounded ends of rod-like bodies. Connector-bodies house said spherical magnets which have hemispherical endpoints for north and south poles which attract and contact other bodies with spherical magnets within, in a point-like fashion, allowing relative free rotation for the respective connector bodies. Also, said rod-like bodies allow the construction of tetrahedral geometries that are illustrated by Vincentelli, without the need for additional, heavy ferromagnetic connector spheres, thus reducing the complexity and increasing the strength of desired structures.

[0012] Still another object and advantage of this disclosure is the provision of a magnetic connector apparatus that can function in the dual role of a play set and a dry-erase surface so that the user can express both architectural and graphic designs.

[0013] Still another object and advantage of this disclosure is the provision of a magnetic connector apparatus that has edges and endpoints of rods that are substantially rounded to conform to the accommodation of a plurality of hollow spherical sockets around the perimeter of said bodies, however said rounding is interrupted by a minor planar area that facilitates planar and right-angle alignment of adjacent connector bodies. Said planar and right-angle alignment facilitates stability and is desired in construction of many forms, including floors, walls and ceilings of play houses.

BRIEF DESCRIPTION OF DRAWINGS

[0014] FIG. **1** shows a front view of the prior art of Ogikubo showing square/block-like connector bodies with spherical magnets within.

[0015] FIG. **2** shows a front view of the present disclosure showing relatively short distance between spherical magnets in corner-to-corner condition.

[0016] FIG. **3** shows an edge view of three magnetic panels with edge-to-edge connections.

[0017] FIG. **4** shows a side view of a square connector body suspended from rod-like connector body. Said square connector body being in relative free rotation.

[0018] FIG. **5** shows a perspective view of an example of the present disclosure in the form of a play house.

[0019] FIG. **6** shows a side view of two polygonal panel casings with planar areas in edge to edge configuration.

DESCRIPTION OF DRAWINGS IN DETAIL

[0020] FIG. **1** shows prior art of Ogikubo (Ogikubo FIG. **3**). Connector body **1** contains spherical magnets **2** and are housed within cube-like or block-like casings **3**. Those skilled in the art may recognize that square corners favor face-to-face connection and disfavor edge-to-edge and corner to corner connections, due to an incresased distance between adjacent connector body magnets.

[0021] FIG. **2** shows an embodiment of the present disclosure. Spherical magnets **12** are housed with a clearance **14**, within spherical sockets **18** which are within polygonal panel casings **10**. Rounded corners **20** conform to and accommodate said spherical magnets **12**, resulting in relatively small separation distance between magnets in corner-to-corner configuration. Thus, as will be readily apparent to those skilled in the art, as the polygonal panel casings are moved toward each other, spherical magnets in adjacent casings rotate freely within spherical sockets in order to align N and S poles of magnets and exert mutual force of attraction to each other. Said small separation distance assures relatively strong mutual force of attraction for connector bodies in face-to-face, edge-to-edge, and corner-to-corner configurations.

[0022] FIG. **3** is a side elevation of a plurality of the magnetic connector bodies. Spherical magnets **12** are housed within polygonal panel casings **10** with substantially rounded edges **22**, such that a plurality of edge-connected bodies form a ring-like structure with an open interior **24**. Those skilled in the art may recognize that said ring-like structure could be opened to form a chain-like structure.

[0023] FIG. **4** shows another example of an embodiment of the present disclosure in the form of an assemblage of a hand-held **26** rod with hemispherically-rounded ends **16** connected through the mutual attraction of magnets **12** at a point on the bottom to a square connector body. Said square connector body is free to rotate from a side-view position **18** to the edge view position **20** in a carousel-like fashion, due to the relatively small contact area between the hemispherically-rounded rod and the rounded corner of the square panel.

[0024] FIG. **5** shows a perspective view of a plurality of connector bodies in the form of a play-house like assemblage including square connector bodies **28**, triangular connector bodies **30** and rod-like connector bodies **16**. Spherical magnets **12** are housed in spherical sockets **18**. In this embodiment, spherical magnets **12** and spherical sockets **18** are located in the corners and midpoints of edges of square and triangular bodies. Said assemblage could enclose an open space within the interior in which figurines, other toys, or small children could inhabit.

[0025] FIG. **6** shows a close-up side view of two polygonal panel casings **10** with planar areas **32** in edge-to-edge configuration. Spherical magnets **12** are housed with a clearance **14** in spherical sockets **18**. Said planar areas comprise a minor segment of the circumference of substantially rounded edges. Those skilled in the art may recognize that said planar areas facilitate both linear alignment of bodies in edge-to-edge configuration and right-angle alignment in edge-to-face configuration.

I claim:

1. A magnetic construction apparatus, comprising at least two magnetic connector bodies each arranged for magnetic connection one to another and each body having a plurality of spherical sockets defined within the corners of the body; and at least two spherical permanent magnets rotatably provided with clearance between said spherical socket and said spherical permanent magnet, in each of the sockets of said body, and said body being substantially concentrically curved with said spherical permanent magnet.

2. A magnetic construction apparatus, comprising at least two magnetic connector bodies each arranged for magnetic connection one to another and each body having a plurality of spherical sockets defined within the corners of the body and at midpoints of edges; and at least two spherical permanent magnets rotatably provided with clearance between said spherical socket and said spherical permanent magnet, in each of the sockets of said body, and said body being substantially concentrically curved with said spherical permanent magnet.

3. A magnetic construction apparatus, comprising at least two rod-like magnetic connector bodies each arranged for magnetic connection one to another and each body having a plurality of spherical sockets defined within the end-points of the rod-like body; and at least two spherical permanent magnets rotatably provided with clearance between said spherical socket and said spherical permanent magnet, in each of the sockets of said body, and said body being substantially concentrically curved with said spherical permanent magnet.

4. The magnetic connector apparatus of claim **1** wherein the connector bodies are flat polygonal panels made from material that is compatible with use as a dry-erase surface.

5. The magnetic connector apparatus of claim **2** wherein the connector bodies are flat polygonal panels made from material that is compatible with use as a dry-erase surface.

6. The magnetic connector apparatus of claim **1** wherein said connector bodies comprise a flat polygonal panel.

7. The magnetic connector apparatus of claim **1** wherein said body being substantially concentrically curved and includes a minor flat area along the circumference of substantially rounded edges

8. The magnetic connector apparatus of claim **2** wherein said body being substantially concentrically curved and includes a minor flat area along the circumference of substantially rounded edges

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