

MAGNETIC SHEET

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to the technical field of toys and teaching aids, and more particularly, to a magnetic sheet.

2. Description of the Related Art

Magnetic sheets are one of the favorite toys for kids. The existing magnetic sheet often takes various shapes, for example, square, rectangle, triangle, circular, polygon. The magnetic sheet mainly comprises a magnetic sheet body and a plurality of magnetic clamping parts. The plurality of magnetic clamping parts have magnets therein and are clamped to the periphery of the magnetic sheet body, allowing the periphery of the magnetic sheet body to become magnetic. Such an arrangement enables the periphery of the magnetic sheet body to be temporally connected to or fixed to peripheries of other magnetic sheets by magnetic force. Since the magnetic sheets have the plurality of magnetic clamping parts therein, they may stick together on every side, and kids may create a variety of shapes by using several pieces of magnetic sheets having various shapes, thus sparking imagination in children of all ages.

The plurality of magnetic clamping parts in the present magnetic sheet are fixed to the magnetic sheet body by clamping or with glue, or they are pressed against the magnetic sheet body by a machine. Of note, a problem with such an arrangement is that the plurality of magnetic clamping parts may be damaged or they may fall off.

SUMMARY OF THE INVENTION

In order to solve the above-mentioned problems in the prior art, the present invention aims to provide a magnetic sheet.

To this end, detailed technical solution adopted in the present invention is as follows:

A magnetic sheet, comprising: a frame structure, a plurality of magnetic structures being arranged on the periphery of the frame structure, the frame structure and the plurality of magnetic structures being integrally formed; wherein each of the plurality of magnetic structures comprises: a steel pipe, a magnet arranged in the steel pipe and plugs at both ends of the steel pipe.

In the above-mentioned the magnetic sheet, wherein a plurality of through holes are provided in the frame structure, the frame structure comprises: an annular outer frame, an annular inner frame disposed in the outer frame, and a connecting part for connecting the outer frame and the inner frame, wherein the plurality of magnetic structures are arranged in

the outer frame.

In the above-mentioned the magnetic sheet, wherein the frame structure further comprises: a plurality of reinforcing ribs disposed on the connecting part, two ends of each of the plurality of reinforcing ribs are connected to the outer frame and the inner frame, respectively, and a first groove is formed between two adjacent reinforcing ribs.

In the above-mentioned the magnetic sheet, wherein a second groove is formed at a side of the outer frame which is close to the inner frame, and two second grooves are formed at two ends of each of the plurality of magnetic structures.

In the above-mentioned the magnetic sheet, wherein the plugs are of an integrated structure, the plugs comprise the following parts in sequence: a cylindrical plugging part, plugged into the steel pipe; a circular-truncated-cone-shaped sealing part for sealing the steel pipe; and a cylindrical connecting part, connected to the frame structure.

In the above-mentioned the magnetic sheet, wherein the plugging part has an outer diameter greater than an outer diameter of the connecting part; a larger bottom surface of the sealing part has an outer diameter greater than the outer diameter of the plugging part, and a smaller bottom surface of the sealing part has an outer diameter less than the outer diameter of the connecting part.

In the above-mentioned the magnetic sheet, wherein the plurality

of through holes are formed in a thickness direction of the frame structure and are evenly distributed along a periphery of the frame structure.

The above-mentioned the magnetic sheet further comprises: a plurality of mushroom pins that are fitted with the plurality of through holes.

The above-mentioned the magnetic sheet further comprises: a luminous system, disposed in the frame structure.

In the above-mentioned the magnetic sheet, wherein the luminous system comprises: a luminous element, a controller for driving the luminous element, and a power supply for powering the luminous element and the controller.

The present invention has the following beneficial effects when compared with the prior art:

Through the magnetic structures which are integrated with the frame structure, after the magnetic sheet is used for a long time, the magnetic structures still can be attached to a magnetic sheet body, and the problems that the magnetic structures are damaged and fall off are avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, together with the specification, illustrate exemplary embodiments of the present disclosure, and, together

with the description, serve to explain the principles of the present invention.

Figure 1 is a front view of a magnetic sheet according to the present invention.

Figure 2 is a top view of a magnetic sheet according to the present invention.

Figure 3 is a perspective view of a magnetic sheet according to the present invention.

Figure 4 is a schematic view of a magnetic structure of a magnetic sheet according to the present invention.

Figure 5 is a front view of a magnetic structure of a magnetic sheet according to the present invention.

Figure 6 is a front view of a plug of a magnetic structure of a magnetic sheet according to the present invention.

Figure 7 is a schematic view of a mushroom pin of a magnetic sheet according to the present invention.

Figure 8 is schematic view of a bigeminy mushroom pin of a magnetic sheet according to the present invention.

Figure 9 is schematic view of a trigeminy mushroom pin of a magnetic sheet according to the present invention.

Figure 10 is another schematic view of a trigeminy mushroom pin of a magnetic sheet according to the present invention when observed

from another angle.

Reference numerals:

1. frame structure, 11. outer frame, 111. second groove, 12. inner frame, 13. connecting part, 14. reinforcing rib, 141. first groove, 15. groove, 2. through hole, 3. magnetic structure, 31. steel pipe, 32. magnet, 33. plug, 331. plugging part, 332. sealing part, 333. connecting part, 4. mushroom pin, 41. single mushroom pin, 42. bigeminy mushroom pin, 421. single mushroom pin portion, 422 bigeminy connecting part, 43. trigeminy mushroom pin, 431. single mushroom pin portion, 432. trigeminy connecting part.

DETAILED DESCRIPTION

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like reference numerals refer to like elements throughout.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the

invention. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” or “includes” and/or “including” or “has” and/or “having” when used herein, specify the presence of stated features, regions, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

As used herein, the term “plurality” means a number greater than one.

Hereinafter, certain exemplary embodiments according to the present disclosure will be described with reference to the accompanying drawings.

Figure 1 is a front view of a magnetic sheet according to the present invention. Figure 2 is a top view of a magnetic sheet according to the present invention. Figure 3 is a perspective view of a magnetic sheet according to the present invention. Figure 4 is a schematic view of a magnetic structure of a magnetic sheet according to the present invention. Figure 5 is a front view of a magnetic structure of a magnetic sheet according to the present invention. Figure 6 is a front view of a plug of a magnetic sheet according to the present invention. With reference to Figures 1 to 3, there is shown a preferred embodiment of a magnetic sheet, comprising: a frame structure 1, which is an annular square structure in this embodiment; in other embodiments, the frame structure may be rectangular, circular, triangular, diamond, parallelogram, polygon, or other planar shapes; in other embodiments, the frame structure 1 may be of a tapered shape, a cylindrical shape, a circular-truncated-cone shape, a pyramid shape, or other three-dimensional shapes. A plurality of through holes 2 are formed in the frame structure 1. A plurality of magnetic structures 3 are provided along a periphery of the frame structure 1. The plurality of magnetic structures 3 allow for a detachable connection among the same type of or different types of frame structures. The frame structure 1 is integrally formed with the plurality of magnetic structures 3, so as to prevent the magnetic structures 3 from being damaged or falling off when they have been in use for a long time.

Furthermore, in a preferred embodiment, each of the plurality of magnetic structures 3 comprises: a steel pipe 31, a magnet 32 arranged in the steel pipe 31 and plugs 33 at both ends of the steel pipe 31. In a further preferred embodiment, the steel pipe 31 may be a tubular structure made of other materials, for example, the steel pipe 31 may be replaced by a plastic pipe. Preferably, the magnet 32 is a cylinder. The magnetic structure 3 is configured to allow the magnet 32 to freely rotate in an interior of the steel pipe 31 about an axis, so that the magnetic structures may adaptively adjust a direction of a magnetic pole when magnetically attached to other magnetic sheets. The steel pipe is sealed by the plugs 33, so molding materials for the frame structure 1 may not come into contact with the magnet 32 when the frame structure 1 is integrally formed by the molding materials, and the fixing of the magnet 32 may be avoided.

Furthermore, in a preferred embodiment, the frame structure 1 comprises: an annular outer frame 11, an annular inner frame 12 disposed in the outer frame 11, and a connecting part 13 for connecting the outer frame 11 and the inner frame 12, wherein the plurality of magnetic structures 3 are arranged in the outer frame 11. Preferably, the outer frame 11 may have a longitudinal section in the shape of circle or in the shape of ellipse; the inner frame 12 may have a longitudinal section in the shape of circle or in the shape of ellipse; and the connecting part 13 may have a longitudinal section in the shape of rectangle. Both the outer frame 11 and

the inner frame 12 have a thickness greater than that of the connecting part 13, such that an annular groove 15 is formed between the outer frame 11 and the inner frame 12. Wherein, a surface of the connecting part 13 is formed as a bottom surface of the groove 15, and a side surface of the outer frame 11 and a side surface of the inner frame 12 are formed as side walls of the groove 15.

Furthermore, in a preferred embodiment, the frame structure 1 further comprises: a plurality of reinforcing ribs 14 disposed on the connecting part 13, two ends of each of the plurality of reinforcing ribs 14 are connected to the outer frame 11 and the inner frame 12, respectively. Specifically, the plurality of reinforcing ribs 14 are disposed in the groove 15. Preferably, each of the plurality of magnetic structures 3 is provided with a reinforcing rib 14. In a further preferred embodiment, more than one reinforcing ribs 14 are arranged between the outer frame 11 and the inner frame 12, so as to adjust the overall strength of the magnetic sheet. A first groove 141 is formed between two adjacent reinforcing ribs 14. The first groove 141 is formed by a first projection on a mold which is at a side surface of the magnetic structure 3. When the magnetic structures 3 are put into the mold, the side surface of the magnetic structure abuts against the first projection, such that the magnetic structure 3 may be limited by the mold in a radial direction.

Furthermore, in a preferred embodiment, a second groove 111 is

formed on a side of the outer frame 11 which is close to the inner frame 12, and two ends of each of the plurality of magnetic structures 3 are provided with two second grooves 111. The second groove 111 is formed by a second projection located on the two ends of the magnetic structure 3. When the magnetic structures 3 are put into the mold, the two ends of the magnetic structure 3 abut against the second projection, such that the magnetic structure 3 may be limited by the mold in an axial direction.

A method for integral forming the magnetic sheet will be described hereinafter:

Step S1, providing an upper die and a lower die, forming a plurality of first projections and a plurality of second projections on the upper die and the lower die, respectively, wherein the plurality of first projections are located at two ends of a predetermined position of the magnetic structure 3, and the plurality of second projections are located at a side surface at a predetermined position of the magnetic structure 3;

Step S2, placing the plurality of magnetic structures 3 in the predetermined positions for closed-die forging.

In Step S1, the plurality of first projections and the plurality of second projections are fixedly connected to the upper die or the lower die.

In Step S2, preferably, the plurality of second projections are iron rods fixed to the upper die or the lower die.

In Step S2, the two ends of the magnetic structure 3 abut against

the first projections, respectively, and the side surface of the magnetic structure 3 abuts against the second projections, so as to position the magnetic structures 3 during the process of casting.

The above descriptions are only the preferred embodiments of the invention, not thus limiting the embodiments and scope of the invention.

The present invention also has the following embodiments based on the above-mentioned embodiments:

In a further embodiment of the present invention, with reference to Figures 1 to 6, the plugs 33 are of an integrated structure, the plugs 33 comprise the following parts in sequence: a cylindrical plugging part 331, plugged into the steel pipe 31; a circular-truncated-cone-shaped sealing part 332 for sealing the steel pipe 31; and a cylindrical connecting part 33, connected to the frame structure 1. When the frame structure 1 is integrally formed, part of materials of the frame structure 1 are wrapped outside the connecting part 333; furthermore, part of materials of the frame structure 1 may be wrapped around a part of the sealing part 332, such that movement of the magnetic structures 3 in a direction of the periphery of the magnetic sheet is limited, and movement of the magnetic structures 3 in the radial direction of the magnetic sheet is also limited.

In a further embodiment of the present invention, when the frame structure 1 is integrally formed, part of materials of the frame structure 1 may also be wrapped around the side surface of the steel pipe 31, so as to

further limit the movement of the magnetic structure 3 in the radial direction of the magnetic sheet.

In a further embodiment of the present invention, the plugging part 331 has an outer diameter greater than an outer diameter of the connecting part 333; a larger bottom surface of the sealing part 332 has an outer diameter greater than the outer diameter of the plugging part 331, and a smaller bottom surface of the sealing part 332 has an outer diameter less than the outer diameter of the connecting part 333.

In a further embodiment of the present invention, the plurality of through holes 2 are formed in a thickness direction of the frame structure 1 and are evenly distributed along a periphery of the frame structure 1. In the embodiment, since the frame structure is of a square shape, the plurality of through holes 2 are preferably arranged in corners of the frame structure 1; while when the frame structure 1 takes other shapes, the through holes 2 may be arranged as desired.

In a further embodiment of the present invention, when the frame structure 1 is of a triangular shape, both the number of the through holes 2 and the number of magnetic structures are preferably 3, the through holes 2 are arranged in the corners of the frame structure 1, the magnetic structures 3 are arranged on sides of the frame structure 1; when the frame structure 1 is of a quadrangular shape, both the number of the through holes 2 and the number of the magnetic structures are preferably

4, the through holes 2 are arranged in the corners of the frame structure 1, the magnetic structures 3 are arranged on the sides of the frame structure 1; when the frame structure 1 is of a polygonal shape, it is configured in the same manner as described above.

In a further embodiment of the present invention, when the frame structure 1 is of a circular shape, the through holes 2 and the magnetic structures 3 are uniformly and alternatively disposed at the periphery of the frame structure 1.

In a further embodiment of the present invention, when the frame structure 1 is of a three-dimensional shape, the number of the through holes 2 is preferably determined by the number of the corners of the frame structure 1, and the number of the magnetic structures 3 is preferably determined by the number of edges of the frame structure 1.

In a further embodiment of the present invention, when the frame structure 1 is of a three-dimensional structure and has a curved surface, the magnetic structures 3 may be arranged on the curved surface.

Figure 7 is a schematic view of a mushroom pin of a magnetic sheet according to the present invention. Figure 8 is schematic view of a bigeminy mushroom pin of a magnetic sheet according to the present invention. Figure 9 is schematic view of a trigeminy mushroom pin of a magnetic sheet according to the present invention. Figure 10 is another schematic view of a trigeminy mushroom pin of a magnetic sheet

according to the present invention when observed from another angle.

In a further embodiment of the present invention, the magnetic sheet further comprises: a plurality of mushroom pins that are fitted with the plurality of through holes 2. Two magnetic sheets may be connected with each other by the mushroom pin. In addition, the mushroom pin may be selectively arranged to form an angle between the two magnetic sheets, and to establish a variety of patterns or structures formed by the magnetic sheets. Combination between different number of mushroom pins and through holes enables all kinds of connections among the magnetic sheets.

In a further embodiment of the present invention, the mushroom pin may be a single mushroom pin 41, as shown in Figure 7. The single mushroom pin 41 is of a columnar structure in the form of hemisphere at two ends thereof, wherein the two ends of the single mushroom pin 41 has an outer diameter slightly greater than that of a central portion thereof. The two magnetic sheets may be stacked on each other and fixed relative to each other in its thickness direction by the single mushroom pin 41.

In a further embodiment of the present invention, the mushroom pin may be a bigeminy mushroom pin 42, as shown in Figure 8. The bigeminy mushroom pin 42 comprises two single mushroom pin portions 421 and a bigeminy connecting part 422 for connecting the two single mushroom pin portions 421. Preferably, the bigeminy connecting part 422

is made of a flexible material, such that the two single mushroom pin portions 421 on the two sides of the bigeminy connecting part 422 may move with respect to each other, so as to adapt the various angles between the two magnetic sheets. The two magnetic sheets may be arranged and fixed to each other in a length direction, in a width direction or in a radial direction by the bigeminy connecting part 42.

In a further embodiment of the present invention, the mushroom pin may be a trigeminy mushroom pin 43, as shown in Figure 9 and Figure 10. The trigeminy mushroom pin 43 comprises three single mushroom pin portions 431 and a trigeminy connecting part 432 for connecting the three single mushroom pin portions 431. Preferably, the trigeminy connecting part 432 is made of a flexible material, such that the single mushroom pin portions 421 thereon may move with respect to each other, so as to adapt the various angles between the two magnetic sheets. Preferably, the trigeminy connecting part 432 is of a cambered surface. Every two of the three magnetic sheets may be arranged to be perpendicular to each other and fixed to each other by the trigeminy mushroom pin 43.

In a further embodiment of the present invention, in a preferred case, the three single mushroom pin portions 431 of the trigeminy mushroom pin 43 are perpendicular to one another; in other cases, the three single mushroom pin portions 431 of the trigeminy mushroom pin

43 may be formed at other angles, such that the three magnetic sheets may be formed to be different shapes and fixed to one another.

In a further embodiment of the present invention, the magnetic sheet further comprises: a luminous system (not shown in the figures), disposed in the frame structure 1.

In a further embodiment of the present invention, the luminous system comprises: a luminous element, a controller for driving the luminous element, and a power supply for powering the luminous element and the controller.

In a further embodiment of the present invention, the luminous element may be LED lamp beads, electroluminescent sheets, and light emitting diodes, and so on.

In a further embodiment of the present invention, the luminous element may also be electroluminescent power suspended within the material of the frame structure 1.

In a further embodiment of the present invention, the controller has a built-in program for controlling the illumination of the luminous element. Moreover, the controller is used to drive the luminous element to flash constantly or briefly, to be on or off for a continuous time, and to perform a combination of two thereof.

The above descriptions are only the preferred embodiments of the invention, not thus limiting the embodiments and scope of the invention.

Those skilled in the art should be able to realize that the schemes obtained from the content of specification and drawings of the invention are within the scope of the invention.

What is claimed is:

1. A magnetic sheet, comprising:

a frame structure, a plurality of magnetic structures being arranged on the periphery of the frame structure, the frame structure and the plurality of magnetic structures being integrally formed;

wherein each of the plurality of magnetic structures comprises: a steel pipe, a magnet arranged in the steel pipe and plugs at both ends of the steel pipe.

2. The magnetic sheet of claim 1, wherein a plurality of through holes are provided in the frame structure, the frame structure comprises: an annular outer frame, an annular inner frame disposed in the outer frame, and a connecting part for connecting the outer frame and the inner frame, wherein the plurality of magnetic structures are arranged in the outer frame.

3. The magnetic sheet of claim 2, wherein the frame structure further comprises: a plurality of reinforcing ribs disposed on the connecting part, two ends of each of the plurality of reinforcing ribs are connected to the outer frame and the inner frame, respectively, and a first groove is formed between two adjacent reinforcing ribs.

4. The magnetic sheet of claim 2 or 3, wherein a second groove is formed at a side of the outer frame which is close to the inner frame, and two second grooves are formed at two ends of each of the plurality of magnetic structures.

5. The magnetic sheet of claim 1, wherein the plugs are of an integrated structure, the plugs comprise the following parts in sequence: a cylindrical plugging part, plugged into the steel pipe; a circular-truncated-cone-shaped sealing part for sealing the steel pipe; and a cylindrical connecting part, connected to the frame structure.

6. The magnetic sheet of claim 5, wherein the plugging part has an outer diameter greater than an outer diameter of the connecting part; a larger bottom surface of the sealing part has an outer diameter greater than the outer diameter of the plugging part, and a smaller bottom surface of the sealing part has an outer diameter less than the outer diameter of the connecting part.

7. The magnetic sheet of claim 1, wherein the plurality of through holes are formed in a thickness direction of the frame structure and are evenly distributed along a periphery of the frame structure.

8. The magnetic sheet of claim 7, further comprising: a plurality of mushroom pins that are fitted with the plurality of through holes.

9. The magnetic sheet of claim 1, further comprising: a luminous system, disposed in the frame structure.

10. The magnetic sheet of claim 9, wherein the luminous system comprises: a luminous element, a controller for driving the luminous element, and a power supply for powering the luminous element and the controller.