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(54) **A ROD OF VARIABLE LENGTH FOR CONSTRUCTION TOYS**

STANGE MIT VARIABLER LÄNGE FÜR BAUSPIELZEUGE

TIGE DE LONGUEUR VARIABLE POUR JOUETS DE CONSTRUCTION

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(73) Proprietor: **Smart NV
2550 Kontich (BE)**

(72) Inventor: **VANDOREN, Rolf
2550 Kontich (BE)**

(74) Representative: **Brantsandpatents bv
Pauline Van Pottelsberghelaan 24
9051 Ghent (BE)**

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Description

Technical field

[0001] The present invention relates to a rod for construction toys. In particular, the invention relates to a rod of variable length for construction toys.

Background

[0002] US9789417B2 discloses a construction toy, comprising a rod with two opposite ends, provided with a magnetic element at each end. The toy further comprises balls that can be suitably affixed to the rod.

[0003] This invention has a number of limitations concerning the design of the toy. The toy has a low degree of freedom when connecting the rods to construct the toy. For example, each rod has a fixed length. Furthermore, the rod is rigid and cannot be deformed without breaking.

[0004] US2005227574 discloses an adjustable length connection arm for the use in building toy geometrical structures. The adjustable length connection arm consists of a first member slidably and telescopically mounted to a second member and selectively positionable with respect to the second member.

[0005] This invention relates to a magnetic connection arm that is only slidably and telescopically movable in the axial direction of the connection arm. Additionally, the length of the connection arm is adjustable in the axial direction by selectively positioning a latch carried by the first member into captive engagement with any one of a multiplicity of axially spaced openings in the second member. The selective positioning includes the latch in a fixed relationship. Meaning that once the latch is placed into captive engagement, the length of the connection arm is fixed in the axial direction. This invention thus lacks the ability to undergo radial displacement of the whole connection arm. Furthermore, the connection arm is rigid and cannot be deformed without breaking.

[0006] EP 2340881 discloses a construction kit that comprises rod shaped base parts and coupling parts that are designed in a bendable and/or extended manner. The base parts are connected via a pin to the coupling parts.

[0007] This invention relates to a construction kit that provides construction elements for the construction of a structural form. Such a structural form needs several pieces in order to embody a curved or bended shape. These pieces comprise: coupling parts, extension parts, intrusion parts and base parts. The target audience for a construction toy are in the first place children. The invention disclosed in EP 2340881 is not child-friendly since it involves a lot of parts to only just construct one bended piece.

[0008] KR 20190038497 discloses a stereoscopic toy which comprises a planar panel in which a magnetic body is embedded and a plurality of slots or engagement

grooves are formed along a periphery thereof. This invention relates to a toy whereof the length is only variable in the longitudinal direction of the toy.

[0009] The present invention aims to resolve at least some of the problems mentioned above.

SUMMARY OF THE INVENTION

[0010] In a first aspect, the present invention relates to a rod for construction toys, according to claim 1. Preferred embodiments of the rod are provided in claims 2 to 7.

[0011] The rod extends in a longitudinal axis. The rod comprises two opposite ends. The opposite ends are spaced from one another by a rod length. It is an advantage of embodiments of the present invention that the rod length is variable.

[0012] It is an advantage of embodiments of the present invention that the rod length is variable between a first length and a second length, wherein the second length is longer than the first length. It is an advantage of embodiments of the present invention that varying the length between the first length and the second length may be done many times before the rod wears off. It is an advantage of embodiments of the present invention that the material of the rod allows varying the length between the first length and the second length without breaking said rod.

[0013] It is an advantage of embodiments of the present invention that a bended or curved formation of the rod can be achieved with only one rod. In this way the total number of parts can be reduced to form a bended or curved formation of the rod, which benefits the use for children i.e. the target audience for the invention.

[0014] Varying the length of the rod requires a minimum amount of force. It is an advantage of embodiments of the present invention that without the minimum amount of force, the rod length stays the same.

[0015] Each rod end is provided with a magnetic element. The polarity of the magnetic element may be a south pole or a north pole. It is an advantage of embodiments of the present invention that the two rod ends may comprise magnetic elements of the same or the opposite polarity. It is an advantage of embodiments of the present invention that two rod ends comprising magnetic elements of the opposite polarity are attracted to one another. It is an advantage of embodiments of the present invention that two rod ends comprising magnetic elements of the same polarity are repelled from one another.

[0016] Each rod end comprises a cap. It is an advantage of embodiments of the present invention that the cap is capable of removably keeping the magnetic element in place. It is an advantage of embodiments of the present invention that the magnetic element on a rod end is changeable or replaceable by removing the cap. It is an advantage of embodiments of the present invention that the magnetic element on a rod end is changeable or replaceable without breaking or disassembling the rod,

but only by removing the cap. It is an advantage of embodiments of the present invention that the magnetic elements are strong enough and capable of allowing two rod ends in close proximity of one another to interact magnetically. It is an advantage of embodiments of the present invention that the cap is capable of allowing two rod ends to be in close proximity of one another so as to interact magnetically. It is an advantage of embodiments of the present invention that the cap is capable of keeping the magnetic elements in place without covering the magnetic element so as to easily allow magnetic interaction between the magnetic element and another element.

[0017] The rod may have a telescopic configuration, comprising at least one outer and at least one inner elongated hollow member. It is an advantage of embodiments of the present invention that the at least one outer member is adapted to slidably receive the at least one inner member. It is an advantage of embodiments of the present invention that the at least one inner member is adapted to slidably extend out of said outer member. It is an advantage of embodiments of the present invention that a variable rod length is obtained by extending or retracting the at least one inner member in the at least one outer member.

[0018] The rod may further comprise a locking mechanism. It is an advantage of embodiments of the present invention that the locking mechanism is adapted to fix the inner member at predetermined positions relative to the outer member. The rod may further comprise a locking structure. It is an advantage of embodiments of the present invention that the locking mechanism is capable of preventing the inner member from completely disengaging or disconnecting from the outer member.

[0019] The rod may, alternatively to the telescopic configuration, have an accordion configuration. The rod may have a rod width. The rod width may vary periodically between a first width and a second width different than the first width, resulting in an accordion configuration. It is an advantage of embodiments of the present invention that a variable length rod is obtained using the accordion configuration.

[0020] The rod having a first width has a first cross-section, and the rod having a second width has a second cross-section, wherein the shortest distance between the first and the second cross-sections is a partial length. It is an advantage of embodiments of the present invention that the partial length is variable between a third length and a fourth length, wherein the third length and the fourth length are not equal.

[0021] The rod may be deformable. It is an advantage of embodiments of the present invention that the accordion configuration allows the rod to be deformable. It is an advantage of embodiments of the present invention that a non-straight rod is obtained. It is an advantage of embodiments of the present invention that a curved rod is obtained. It is an advantage of embodiments of the present invention that the rod can be deformed without breaking said rod. It is an advantage of embodiments of

the present invention that the rod can be repeatedly returned to its original form according to the desire of the user. It is an advantage of embodiments of the present invention that the rod can be deformed many times. It is an advantage of embodiments of the present invention that the rod is made of a material that allows the rod to deform many times before wearing off. It is an advantage of embodiments of the present invention that the rod has a long lifetime.

[0022] In a second aspect, the present invention relates to a construction toy, according to claim 8. Preferred embodiments of the toy are provided in claim 9 to 11.

[0023] The toy comprises at least two rods according to the first aspect of the present invention. The toy may further comprise at least one magnetic connecting element.

[0024] It is an advantage of embodiments of the present invention that the connecting element is adapted to be attached magnetically to at least one rod end. It is an advantage of embodiments of the present invention that the connecting element may comprise partially or fully a north pole or a south pole, or a combination thereof.

[0025] Although the connecting element is preferable, the rod ends may be connected to one another without a connecting element, e.g. two rod ends may interact magnetically with one another without a connecting element. It is an advantage of embodiments of the present invention that a toy comprising of only a plurality of rods is obtained.

[0026] The connecting element may have an ellipsoid configuration. The cap may be configured to receive the ellipsoid connecting element. For example, the radius of curvature of said element may be matched to that of the cap. It is an advantage of embodiments of the present invention that the connecting element is in close proximity to the magnetic element due to matching the configuration of the cap and of the connecting element.

[0027] It is an advantage of embodiments of the present invention that the connecting element is adapted to be attached magnetically to a plurality of rod ends. The ellipsoid may comprise more than one polarity at different points thereof. It is an advantage of embodiments of the present invention that rod ends comprising different polarities may magnetically attach to the same connecting element.

[0028] As shown in the first aspect of the present invention, the rod in the toy may be deformable. It is an advantage of embodiments of the present invention that a higher degree of freedom is obtained when constructing the toy. It is an advantage of embodiments of the present invention that the toy comprises both straight and non-straight rods. It is an advantage of embodiments of the present invention that two rods may be connected to one another, forming a toy of a circular configuration.

[0029] In a third aspect, the present invention relates to a method according to claim 12 for producing a rod.

[0030] The method comprises providing a rod comprising two opposite ends. The method further comprises

configuring the rod to be of a variable length. The method further comprises providing a plurality of magnetic elements. It is an advantage of embodiments of the present invention that magnetic elements with different polarities may be provided.

[0031] The method further comprises configuring each end to removably receive one magnetic element. The method may further comprise fixing the magnetic elements on the two opposite rod ends. It is an advantage of embodiments of the present invention that fixing the magnetic elements allows the rod ends to interact magnetically with other magnetic elements.

[0032] The method further comprises providing a plurality of caps. The method may further comprise removably fixing the magnetic elements on rod ends using the caps, wherein each cap is adapted to removably keep the magnetic element in place. It is an advantage of embodiments of the present invention that the magnetic elements on rod ends are replaceable or changeable.

[0033] In a fourth aspect, the present invention relates to a method according to claim 13 for producing a construction toy.

[0034] The method comprises the steps of the method according to the third aspect of the present invention.

[0035] The method further comprises providing a connecting element. The connecting element is adapted to be attached magnetically to at least one rod end. The method may further comprise configuring the connecting element so as to complement the interface of the rod end.

[0036] In a fifth aspect, the present invention relates to a kit according to claim 14 for constructing a rod.

[0037] The kit comprises at least one rod. The kit further comprises a plurality of magnetic elements. The kit further comprises a plurality of fixing elements, wherein each fixing element is configured to fix one magnetic element on one rod end.

[0038] In a sixth aspect, the present invention relates to a kit according to claim 15 for constructing a construction toy.

[0039] The kit comprises the kit according to the fifth aspect of the present invention.

[0040] The kit further comprises at least one magnetic connecting element, wherein the connecting element is adapted to be attached magnetically to at least one rod end.

[0041] Further advantages of the invention and in particular of preferred embodiments, are disclosed in the detailed description below.

DESCRIPTION OF THE FIGURES

[0042]

Fig. 1 shows a prior art rod (1) for a construction toy, disclosed in US9789417B2.

Fig. 2-9 show a rod (15, 20) for a construction toy (37), according to embodiments of the present in-

vention.

Fig. 2 shows a telescopic rod (15) in (a) a reduced configuration, and (b) an expanded configuration, according to embodiments of the present invention.

Fig. 3 shows an accorded rod (20) in (a) a reduced configuration, and (b) an expanded configuration, according to embodiments of the present invention.

Fig. 4 shows a three-dimensional view of an accorded rod (20), according to embodiments of the present invention.

Fig. 5 shows a disassembled cap (18), according to embodiments of the present invention.

Fig. 6 shows a side view of an accorded rod (20), wherein a cross-section of the cap is visible, according to embodiments of the present invention.

Fig. 7 shows (a) a side view, (b) a three dimensional view, and (c) a cross-section of a cap (18), according to embodiments of the present invention.

Fig. 8 shows a two connected rods (20) through a spherical connecting element (30), forming a construction toy (37), according to embodiments of the present invention.

Fig. 9 shows a plurality of connected rods (20) with and without a spherical connecting element (30), forming a construction toy (37), according to embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0043] The present invention relates to a rod for construction toys.

[0044] Unless otherwise defined, all terms used in disclosing the invention, including technical and scientific terms, have the meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. By means of further guidance, term definitions are included to better appreciate the teaching of the present invention.

[0045] As used herein, the following terms have the following meanings:

"A", "an", and "the" as used herein refers to both singular and plural referents unless the context clearly dictates otherwise. By way of example, "a contaminant" refers to one or more than one contaminant.

[0046] "About" as used herein referring to a measurable value such as a parameter, an amount, a temporal duration, and the like, is meant to encompass variations of +/-20% or less, preferably +/-10% or less, more preferably +/-5% or less, even more preferably +/-1% or less, and still more preferably +/-0.1% or less of and from the

specified value, in so far such variations are appropriate to perform in the disclosed invention. However, it is to be understood that the value to which the modifier "about" refers is itself also specifically disclosed.

[0047] "Comprise," "comprising," and "comprises" and "comprised of" as used herein are synonymous with "include," "including," "includes" or "contain," "containing", "contains" and are inclusive or open-ended terms that specifies the presence of what follows e.g. component and do not exclude or preclude the presence of additional, non-recited components, features, element, members, steps, known in the art or disclosed therein.

[0048] The recitation of numerical ranges by endpoints includes all numbers and fractions subsumed within that range, as well as the recited endpoints.

[0049] In a first aspect, the present invention relates to a rod for construction toys, according to claim 1.

[0050] In a preferred embodiment, the rod extends in a longitudinal axis, e.g. the rod is elongated in the longitudinal axis e.g. in a longitudinal direction. The rod comprises two opposite ends. The opposite ends are spaced from one another by a rod length. The rod is adapted such that the rod length is variable. In a preferred embodiment, the rod may be hollow. Further, the rod, or elements forming the rod, may be cylindrical or octagonal cross-sections.

[0051] In a preferred embodiment, the rod length is variable between a first length and a second length. The second length is longer than the first length. For example, the first length is the length of a contracted or a shrunk or a reduced rod, or the shortest possible rod length. Furthermore, for example, the second length is the length of an expanded or an enlarged rod, or the longest possible rod length.

[0052] In a preferred embodiment, varying the length between the first length and the second length may be done many times e.g. regularly, e.g. by the user, before the rod wears off, for example more than 1,000 times, or more than 10,000 times, or more than 100,000 times.

[0053] In a preferred embodiment, varying the length requires a minimum amount of force, for example a pull or push force, for example a reasonable amount of force by e.g. the hands or fingers of the user. For example, once the rod is at a certain length, said rod stays at that length. For example, without a minimum amount of force, the rod length stay the same. For example, the rod is adapted to maintain a desired length decided by the user. For example, when connecting the rod to other rod, the rod may sustain any forces exerted by other rods on the rod, below the minimum amount of force, without varying the length. For example, forces due to the gravity due to supporting the rod to other rods placed on top of said rod may not be enough to change the length of the rod, e.g. unless the number of rods placed on top is very high.

[0054] In a preferred embodiment, the rod is made of a material that allows said rod to be regularly elongated and/or retracted, without wearing off.

[0055] In a preferred embodiment, each rod end is pro-

vided with a magnetic element. The magnetic element may be facing outwards e.g. away from the rod. The polarity of the magnetic element may be a south pole or a north pole. the magnetic element e.g. having a disk or a cylindrical configuration, may have two polarities, one on each side. The two rod ends may comprise magnetic elements of the same or the opposite polarity, for example the rod ends may be both comprising magnetic elements of a north pole polarity, or of a south pole polarity, or one may be of a north pole polarity and the other of a south pole polarity. Rods with magnetic elements may magnetically interact with one another. For example, rods comprising magnetic elements of the opposite polarities may be magnetically attracted to one another. For example, rods comprising magnetic elements of the same polarity may be magnetically repelled from one another.

[0056] In a preferred embodiment, each rod end may comprise a fixing element, for example a cap or a fastening element. The cap is adapted such that the magnetic element at each rod end is kept in place. The cap is removable, such that the magnetic element kept in place by the cap is changeable or replaceable by removing the cap, so as to change the polarity of the rod end. For example, the magnetic element at one rod end may be replaced or changed without breaking or disassembling the rod.

[0057] In a preferred embodiment, the cap comprises two half-circular structures that may be removably clipped to one another, and fastened by a removable truncated cone structure by e.g. placing on the two half-circular structures. The truncated cone may taper the rod from a first taper width to a second taper with, with a tapering angle, e.g. 45°.

[0058] In a preferred embodiment, the cap is adapted such that two rod ends may be allowed to get in close proximity of one another. In a preferred embodiment, the cap is adapted such that two rod ends with magnetic elements that are in close proximity of one another may be connected to one another. For example, two rod ends that are in close proximity of one another may magnetically interact with one another. For example, the form or the configuration of the cap allows two rod ends to come into close proximity of one another and therefore interact magnetically with one another. For example, the cap is adapted to receive a magnetic element in a spherical or an ellipsoidal configuration. For example, such magnetic interaction between two rod ends may keep the rod ends in place. For example, the cap is preferably configured as a truncated cone, allowing the magnetic element to interact magnetically with other magnetic elements through the hole in the truncated cone.

[0059] In a preferred embodiment, the cap is adapted to have at its end, at the side facing away from the rod, a spherical depression. For example, the spherical depression allows a spherical element with a radius of curvature close to or equal to that of the cap, to come in close proximity with the magnetic element e.g. for magnetic interaction. Alternatively, the cap is adapted to com-

plement the form and size of another element desired to come in close contact to said cap.

[0060] In a preferred embodiment, the magnetic element is strong enough and capable of allowing two rod ends in close proximity of one another to interact magnetically. For example, the magnetic flux density may be around 0.01 Tesla.

[0061] In a preferred embodiment, the rod may have a telescopic configuration. The rod may comprise at least one outer and at least one inner elongated hollow member, engaged with one another e.g. the inner member is inside the outer member. The at least one outer member is adapted to slidably receive the at least one inner member. For example, the inner member is adapted to slidably being inserted into the outer member. For example, the at least one inner member is adapted to slidably extend out of said outer member. Inserting the inner member into the outer member, or extending the inner member out of the outer member, results in changing the rod length.

[0062] In a more preferred embodiment, the rod may comprise two outer elongated hollow members, connected by one inner elongated hollow member. Alternatively, the rod may comprise two inner elongated hollow members, connected by one outer elongated hollow member. Alternatively, any number of inner or outer elongated hollow members may be suitable.

[0063] In a preferred embodiment, the rod may further comprise a locking mechanism. The locking mechanism is adapted to fix the at least one inner member at predetermined positions relative to the at least one outer member. For example, a locking structure fixed on the inner member may engage with the locking mechanism at predetermined positions, so as to lock (e.g. lock the position) or fix the inner member in one predetermined position of the predetermined positions, so as to change the rod length.

[0064] In a preferred embodiment, a locking structure, for example provided on the inner member, prevents the inner member from being completely removed or disengaged from the outer member, for example, when the rod reaches the maximum length. For example, the locking structure allows the inner member to extend out of the outer member up to a maximum extending position, after which it cannot extend further.

[0065] In a preferred embodiment, the inner member can slide into the outer member up to a predetermined position, for example, when the rod length reaches the minimum length. For example, the locking structure allows the inner member to be inserted in the outer member up to a maximum insertion position, after which it cannot be inserted further.

[0066] In a preferred embodiment, the inner and outer members are configured as inner and outer cylinders, wherein the inner cylinder is adapted to slidably extend from or be inserted into the outer cylinder, so as to obtain a variable length rod. Any other suitable configuration may be possible.

[0067] In a preferred embodiment, locking mechanism and the locking structure may be adapted to prevent small objects or liquids e.g. saliva from outside of the inner and outer members to get in between the inner member and the outer member and hinders the sliding movement. For example, a gasket between the inner and the outer member may be used to prevent objects getting in between the inner and the outer members, e.g. or prevent objects getting in between the inner and the outer member and hinder the sliding mechanism, e.g. sand or dust particles.

[0068] In a preferred embodiment, sliding the inner member in the outer member requires a minimum amount of force, for example a pull or push force, for example a reasonable amount of force by e.g. the hands or fingers of the user. For example, reasonable amount of force to engage the locking structure at different predetermined positions in the locking mechanism. For example, without a minimum amount of force, the rod length stays the same, e.g. the locking structure would still be engaged at the same position of the locking mechanism.

[0069] In a preferred embodiment, the rod may be disassembled and assembled by the user. For example, each member may comprise two half cylinders clipped on one another. This is beneficial if the user desires to clean the inside of the rod. The components are adapted to be simple for assembling and disassembling by the user. The rod may be adapted to be partially or completely disassembled and assembled by the user.

[0070] In a preferred embodiment, the rod may alternatively to the telescopic configuration, have an accordion configuration. For example, the rod has an accordioned surface. For example, a hollow cylinder with accordioned outer surface. Alternatively, the rod may be hollow and octagonal. The rod has a rod width. For example, the rod may have an outer surface having a rod width. The rod width may vary periodically between a first width and a second width across the rod (e.g. across the longitudinal axis). For example, the first width is longer than the second width. For example, the rod comprises a plurality of periodic structures e.g. foldable structures, or in a zigzag form, wherein the width of said structure varies across the rod (e.g. across the longitudinal axis of the rod) between the first width and the second width.

[0071] In a preferred embodiment, the ratio between the first and the second width changes when varying the rod length.

[0072] In a preferred embodiment, the rod having a first width has a first cross-section, and the rod having a second width has a second cross-section. The shortest distance between the first and the second cross-sections in one periodic structure is a partial length, e.g. one half period of the periodic structure. The partial length is variable between a third length and a fourth length. For example, the third length is the length of a period in a contracted or a shrunk or a reduced rod. Furthermore, for example, the fourth length is the length of an expanded or an enlarged rod. The rod length may be the product of the multiplication of the length of each period (e.g. 2

times the partial length) by the number of periods.

[0073] In a preferred embodiment, the accordion configuration allows variable rod length by varying the partial length between the third and the fourth partial lengths.

[0074] In a preferred embodiment, when varying the partial length between the third partial length and the fourth partial length, the rod width is varied between the first width and the second width. For example, when the rod is expanded and the partial length is at the fourth partial length, the first and the second rod widths are equal. Similarly, when the rod is reduced, and the partial length is at the third partial length, the difference between the first rod width and the second rod width is at a maximum, resulting in obtaining the minimum rod length.

[0075] In a preferred embodiment, the rod may be deformable. The accordion configuration may allow the rod to be deformable. For example, the rod is deformable without breaking said rod. For example, the rod may be deformable according to the desire of the user, and may be returned back to its original form thereafter according to the desire of the user. For example, the rod may be deformed many times, e.g. regularly, before the rod wears off, for example more than 1,000 times, or more than 10,000 times, or more than 100,000 times. Said rod therefore has a long lifetime.

[0076] In a preferred embodiment, the rod may be deformable. For example, the shortest line passing through said rod and said rod ends is not a straight line. For example, the rod is a curved rod. For example, two or three rods connected to one another via their rod ends may form a circular structure. For example, two ends of one rod may be connected to form a circular rod.

[0077] In a preferred embodiment, the rod may be made of a material that allows said rod to be deformable, e.g. polypropylene.

[0078] In a preferred embodiment, deforming or varying the rod length of said accorded rod requires a minimum amount of force, for example a pull or push force, for example a reasonable amount of force by e.g. the hands or fingers of the user.

[0079] In a preferred embodiment, the cross-sections of the rod are circular. Other regular or irregular cross-sections are also possible, for example a regular or irregular polygon. In another preferred example the cross-sections of the rod are an ellipse. Ellipses and irregular polygons can also provide for a twist along their central axis

[0080] In a preferred embodiment, the rod is adapted so as to obtain foldable periodic structures. For example, the rod is adapted so as to obtain folds in the form of foldable periodic structures. For example, when the partial length is at or close to the third length, the periodic structures are folded e.g. to reduce or retract the rod. Similarly when the partial length is at or close to the fourth length, the periodic structures are unfolded e.g. to expand the rod.

[0081] In a preferred embodiment, a folding angle is formed between two consecutive folds in the foldable pe-

riodic structure. For example, between two consecutive folds across the longitudinal rod axis. For example, the angle formed in one periodic structure when varying the rod width. For example, when varying the rod width to obtain a periodic structure e.g. at the outer surface of the rod. For example, the angle formed between two shortest lines, on one periodic structure. The first line is between a point on the surface of the rod wherein the rod having a first width e.g. the first cross-section, and a point on the surface of the rod wherein the rod having a second width e.g. the second cross-section, and the second line is between the point on the surface of the rod wherein the rod having a second width e.g. the second cross-section, and a point on the surface of the rod having a first width e.g. the first cross-section.

[0082] In a preferred embodiment, the folding angle ranges between a first folding angle and a second folding angle. The folding angle ranges between 0° and 180° degrees, preferably between 5° and 100°, and more preferably between 10° and 90°. For example, when the folding angle is at 180°, the periodic structures are unfolded, and the first rod width and the second rod width are equal, resulting in obtaining the maximum rod length. Similarly, when the folding angle is at 0°, the periodic structures are folded, and the difference between the first rod width and the second rod width is at a maximum, resulting in obtaining the minimum rod length.

[0083] In a preferred embodiment, the length of an extended rod may for example be between 10 and 30cm, preferably around 15 cm. The circumference of the rod at width equal to the first taper width is between 1 and 5 cm, preferably around 3 cm. the circumference of the rod at width equal to the second taper width is between 1 and 4 cm, preferably close to 2 cm.

[0084] In a second aspect, the present invention relates to a construction toy, according to claim 8, comprising a rod according to the first aspect of the present invention.

[0085] In a preferred embodiment, the toy may comprise elements e.g. building blocks for constructing the constructing toy, in many different ways and with a high degree of flexibility and according to the desire of the user e.g. children e.g. for educational purposes.

[0086] In a preferred embodiment, the toy comprises at least two rods according to the first aspect of the present invention. The toy may further comprises at least one magnetic connecting element. The connecting element is adapted in size and form to be attached magnetically to at least one rod end e.g. the connecting element is capable of complementing said rod end. For example, the connecting element may have magnetic properties. For example, the surface of the connecting element may comprise partially or fully a north pole or a south pole, or a combination thereof. The connecting element may be hollow, with only the surface thereof having magnetic properties.

[0087] In a preferred embodiment, the toy may comprise rods having different rod lengths. For example, hav-

ing different lengths when completely expanded or when completely retracted.

[0088] In a preferred embodiment, different magnetic elements may have different magnetic strengths. For example, according to the user's desire, magnetic elements with higher magnetic strength may be connected to longer rods, while magnetic elements with lower magnetic strength may be connected to shorter rods, or vice versa. For example, the user may change the magnetic element at each rod end e.g. whenever he desires.

[0089] In a preferred embodiment, the connecting element may have an ellipsoid configuration. For example, the connecting element may be a sphere. The sphere may comprise partially or fully a north pole or south pole, or a combination thereof. For example, half the sphere may be a north pole, while the other half may be a south pole. The sphere is adapted to be attached magnetically to a plurality of rod ends. For example, the sphere may be attached to six rod ends (e.g. three rods), forming for example an xyz coordinates, wherein two ends are along the x-axis, two ends are along the y-axis, and two ends are along the z-axis, and wherein the sphere is at the origin point.

[0090] In a preferred embodiment, the connecting element, e.g. a sphere, comprising of more than one polarity, e.g. half the sphere is a north pole and the other half is a south pole, allows rods of different polarities of attaching to the same sphere e.g. according to their polarities e.g. the rods with a south pole attaching to the half with the north pole, and the rods with a north pole attaching to the half with the south pole. This allows a high degree of freedom while constructing said toy.

[0091] In a preferred embodiment, the toy may be constructed only by a plurality of rods connected to one another, without a connecting element. One of the main advantages of the connecting element is that it is adapted to allow a plurality of rods to be connected to one connecting element e.g. one magnetic sphere.

[0092] In a preferred embodiment, the configuration of the connecting element, e.g. sphere, has a radius of curvature. The radius of curvature is adapted to match that of the cap. In other words, the cap is adapted to receive the connecting element, so as to allow close proximity between the magnetic element and the connecting element, e.g. so as to allow magnetic interaction between the magnetic element and the connecting element.

[0093] In a preferred embodiment, a curvature angle is defined as the angle formed between the longitudinal axis of the rod and a point on the surface of the cap in contact with the connecting element. Said angle is between 30° and 60°, for example close to 45°.

[0094] In a preferred embodiment, the interface of the cap is adapted to complement that of the connecting element, e.g. a spherical interface at the cap to receive the spherical connecting element, with similar size and form, so as to allow close proximity and magnetic interaction between the magnetic element and the connecting element. E.g., spherical connecting element with a cap hav-

ing a spherical depression, wherein both said element and said caps have similar radius of curvature.

[0095] In a preferred embodiment, the rod may be deformable, as shown in the first aspect of the present invention. This embodiment and other embodiments in the present invention allow a higher degree of freedom when constructing the toy. For example, allowing connecting one, two or three rods to one another to form a toy with a circular configuration.

[0096] In a third aspect, the present invention relates to a method according to claim 12 for producing a rod.

[0097] In a preferred embodiment, the method comprises providing a rod. The method further comprises configuring the rod to be of a variable length. For example, configuring the rod to be extendable e.g. by designing said rod as a plurality of extendable structures e.g. foldable structures, and fabricating said rod of a suitable material. For example, configuring the length of the rod to be variable. For example, configuring the rod to maintain a desired length decided by the user. In a preferred embodiment, the rod may comprise features of the rod in the first aspect of the present invention

[0098] In a preferred embodiment, the method further comprise providing a plurality of magnetic elements. For example, providing magnetic elements having a north or a south pole.

[0099] In a preferred embodiment, the method further comprises configuring each end to removably receive one magnetic element. For example, configuring each end to match the form and size of the magnetic element.

[0100] In a preferred embodiment, the method may further comprise fixing using fixing means the magnetic elements on the two opposite rod ends. For example, fixing a north pole on one end, and a south pole on the opposite end, or fixing a north pole on both ends, or fixing a south pole on both ends. In a preferred embodiment, the method may further comprise removing or replacing the magnetic elements by other magnetic elements.

[0101] In a preferred embodiment, the method may further comprise providing a plurality of fixing elements, for example a plurality of caps, as a fixing mean. The method may further comprise fixing each magnetic element using said cap, wherein said cap is adapted to removably keep the magnetic element in place. This renders the magnetic elements replaceable or changeable so as to change the polarity of the rod ends whenever desired by the user.

[0102] In a fourth aspect, the present invention relates to a method according to claim 13 for producing a construction toy.

[0103] In a preferred embodiment, the method comprises the steps of the method according to the third aspect of the present invention. The method further comprises providing a connecting element. The connecting element is adapted to be attached magnetically to at least one rod end. In a preferred embodiment, the toy may comprise features of the toy in the second aspect of the present invention

[0104] In a preferred embodiment, the method may fur-

ther comprise configuring the connecting element so as to complement the interface of the rod end. For example, in case a cap was provided at the rod end, the connecting element is configured to complement the cap. This is beneficial for the connecting element to be in close proximity with the magnetic elements, so as to allow magnetic interaction.

[0105] In a fifth aspect, the present invention relates to a kit according to claim 14 for constructing a rod.

[0106] In a preferred embodiment, the kit comprises at least one rod. The kit further comprises a plurality of magnetic elements. The kit further comprises a plurality of fixing elements, wherein each fixing element is configured to fix one magnetic element on one rod end. The fixing elements may be caps. In a preferred embodiment, the rod may comprise features of the rod in the first aspect of the present invention

[0107] In a sixth aspect, the present invention relates to a kit, according to claim 15, for constructing a construction toy.

[0108] In a preferred embodiment, the kit comprises the kit according to the fifth aspect of the present invention. The kit further comprises at least one magnetic connecting element, wherein the connecting element is adapted to be attached magnetically to at least one rod end. The connecting element is further adapted to allow more than one rod end to be attached magnetically to said connecting element. In a preferred embodiment, the toy may comprise features of the toy in the second aspect of the present invention

[0109] Further characteristics and advantages of embodiments of the present invention will be described with reference to the figures. It should be noted that the invention is not restricted to the specific embodiments shown in these figures or described in the examples, but is only limited by the claims.

[0110] Fig. 1 shows a prior art rod (1) for a construction toy, disclosed in US9789417B2. The rod comprises two ends, each provided with a magnetic element. The rod is connectable to a magnetic ball, to form a construction toy.

[0111] Fig. 2 shows a telescopic rod (15). The rod (15) comprises an inner elongated hollow member (17) and an outer elongated hollow member (16). For example, the members are cylindrical. Each inner member (17) comprises a cap (18), configured as a truncated cone, capable of keeping a magnetic element in place. Magnetic interaction may occur between any two rod ends. The length of the inner member is (L3), while the length of the outer member is (L1). The rod (15) length is variable between a minimum length (L2), and a maximum length (L4), previously referred to as the first length and the second length, respectively. The inner member may not be extended more than shown in Fig. 2B, and may not be inserted more than shown in Fig. 2A. The inner member may be disengaged from the outer member in case the outer member was disassembled. For example, the outer member comprises two parts clipped to one another

to form a cylindrical outer member.

[0112] A locking structure (19) on the inner member (17) prevents the inner member (17) from being completely removed or disengaged from the outer member (16). A locking mechanism (36) may be present to hold e.g. to lock the inner members (17) (e.g. to hold the locking structure) in predetermined positions in the outer member (16), so as to temporarily stop the movement of the inner member (17) relative to the outer member (16) e.g. to stabilize the rod and prevent random unwanted movement or sliding of the inner member. This is important to fix the inner member in place, and only move whenever the user desires to e.g. change the length of the rod. In this example, two inner members (17) and one outer member (16) are present. Different configurations may be feasible. For example, two outer members (16) and one inner member (17).

[0113] Fig. 3 shows an accorded rod (20). The rod (20) comprises a plurality of periodic foldable structures (21). Said structures (21) may be reduced e.g. shrunk e.g. folded on one another, so as to obtain a reduced rod (20) in Fig. 3(a) with a minimum length (L5). The structures (21) may alternatively be expanded e.g. unfolded from one another, so as to obtain an expanded rod (20) in Fig. 3(b) with a maximum length (L6). The minimum length (L5) and maximum length (L6) were previously referred to as the first length and the second length, respectively.

[0114] The cap (18) is tapered from a first taper width (y2) to a second taper width (y1). The angle of cap tapering is (β). One half of the period of the structures (21) is variable between a third and a fourth partial lengths (x1) and (x2), for a reduced and an expanded rod (20), in Fig. 3(a) and (b), respectively. The width of the structures varies between (W2) and (W1), previously referred to as the second and the first width, respectively, so as to obtain an accordion configuration.

[0115] A rod with variable width is advantageous to obtain the foldable structures (21). When the width is varying, a folding angle (α) is formed in one foldable structure (21). The folding angle (α) is formed by two shortest lines along the longitudinal axis of the rod, on one periodic structure. The first line is defined between a point on the surface of the rod wherein the rod having a second width (W2) and the subsequent point on the surface of the rod wherein the rod having a first width (W1), and a line defined between the point on the surface of the rod wherein the rod having a first width (W1) and the subsequent point on the surface of the rod wherein the rod having a second width (W2). Alternatively, the folding angle may be formed by two shortest lines along the longitudinal axis of the rod, on one periodic structure. The first line defined between a point on the surface of the rod wherein the rod having a first width (W1) and a subsequent point on the surface of the rod wherein the rod having a second width (W2), and a line defined between the point on the surface of the rod wherein the rod having a second width (W2) and a subsequent point on the surface of the rod

wherein the rod having a first width (W1).

[0116] For example, the folding angle is (α_1) and (α_2) for a reduced and an expanded rod (20), previously referred to as a first and a second folding angle, respectively. The folding angle ranges between 0° and 180° degrees, however preferably and also as shown in Fig. 3, it ranges between 5° and 100°, and more preferably between 10° and 90°.

[0117] It is notable that the first folding angle (α_1) is smaller than the second folding angle (α_2). The folding angle is a minimum for a reduced rod, and a maximum for an expanded rod. It is further notable that the difference between the first width (W1) and the second width (W2) is higher for a reduced rod, than for an expanded rod. It can be deduced that when increasing the partial length from the third partial length (x1) to the fourth partial length (x2), the difference between the first width and the second width is decreased, and the folding angle is increased.

[0118] The foldable structures (21) are made of a material that can expand and retract many times before wearing off, for example more than 1,000 times, or more than 10,000 times.

[0119] Fig. 4 shows a three-dimensional view of the rod (20). The cap (18) keeps the magnetic element (22) in place. The magnetic element (22) may interact magnetically with another magnetic element through a hole (23) in the cap (18), wherein said cap is configured as a truncated cone.

[0120] Fig. 5 shows a disassembled cap (18), and Fig. 6 further shows a cross-section of said cap (18). The cap (18) comprises two half-circular structures (24) that keep the magnetic element (22) in place, e.g. two clamps. The cap (18) further comprises a joining element (25), which fixes the two half-circular structures (24) together, resulting in fixing the magnetic element (22) in place. To fix the two half-circular structures (24), the joining element (25) is removably placed on the circular receiver structure (28) formed by the two half-circular structures (24). The receiver structure (28) and the joining element (25) may have magnetic properties to interact with one another. Alternatively, the joining element (25) may be removable to release the two half-circular structures (24) and therefore release the magnetic element (22) e.g. to change or replace the magnetic element (22). For example, the two half-circular structures (24) may be clipped on one another. Further, the joining element (25) may be clipped to the structures (24).

[0121] The magnetic element (22) rests on a carrier (26), connected to the rod through a taper structure (27). The carrier (26) may comprise magnetic properties to interact with the magnetic element (22). The two half-circular structures (24) are further adapted to fit on the magnetic element (22) and keep it in place, and further to fit on the taper (27) and on the carrier (26) (by e.g. patterning the two half-circular structures (24) with complementary patterns to the carrier (26) and the taper (27) and the element (22)).

[0122] Fig. 7 (a) shows a side view of a half-circular structure (24), comprising a bottom part (34), a middle part (28), also referred to as the receiver structure (28), and a top part (35). The length of the bottom part (24), middle part (28) and top part (35) is (33), (31) and (32), respectively. The length and form of the middle part (31) is adapted to match that of the joining element (25).

[0123] The two half-circular structures (24), when connected or clipped to one another, form a truncated cone configuration. The joining element (25) is also formed as a truncated cone, to fit on the receiver structure (28).

[0124] The joining element (25) may be adapted to be removed by e.g. pushing the top part (35) of each of the two half-circular structures (24), so as to release the joining element (25). The joining element (25) may alternatively be removed by other ways, for example by having it connect to the receiver structure (28) magnetically, thus releasing it would require to overcome the magnetic interaction between the receiver (28) and the joining element (25).

[0125] Fig. 7 (c) shows a cross section of a cap (18), connected to a spherical connecting element (30). By combining the top parts (35) of the two half-circular structures (24), a curved interface (29) is formed in the space defined between the two top parts (35) with a radius of curvature, so as to receive a curved structure having for example a similar radius of curvature. For example, a curvature angle (θ) is the angle formed between the longitudinal axis of the rod and the surface of the top part (35), as shown in Fig. 7 (b). For example, the curvature angle (θ) is between 30° and 60°. For example, the curvature angle (θ) is close to 45°. For example, the curved interface (29) is adapted to receive the spherical connecting element (30), and allow the magnetic element (22) to interact magnetically with the spherical connecting element (30). The curved interface (29) allows the spherical connecting element (30) to get in close proximity with the magnetic element (22).

[0126] Fig. 8 shows two deformable curved rods (20) connected to one another through a spherical connecting element (30), forming a construction toy (37) with a circular configuration.

[0127] Fig. 9 shows a plurality of rods (20) connected to one another with and without a spherical connecting element (30), forming a construction toy (37). The rods (20) may be deformable as shown, therefore a higher degree of freedom can be obtained when constructing said toy (37).

[0128] The proceeding description gives details of certain embodiments of the present invention. It will, however, be clear that no matter how detailed the above turns out to be in text, the invention may be applied in many ways. It should be noted that the use of certain terminology when describing certain characteristics or aspects of the invention should not be interpreted as implying that the terminology herein is defined again to be restricted to specific characteristics or aspects of the invention to which this terminology is coupled.

Claims

1. A rod (20) for a construction toy (37) comprising two opposite ends spaced from one another by a rod length, wherein each end is provided with a magnetic element (22), wherein the rod (20) extends in a longitudinal axis, wherein the rod (20) has a rod width, wherein the width varies periodically between a first width (W1) and a second width (W2), wherein the ratio between the first and second widths (W1, W2) changes when varying the rod length, and **characterised in that** each end comprises a cap (18) adapted to have at its end, at the side facing away from the rod, a spherical depression, and wherein the angle (θ) formed between the longitudinal axis of the rod and the surface of said spherical depression is between 30° and 60°.
2. A rod (20) according to claim 1, wherein each rod (20) end comprises a fixing element (18), wherein the fixing element (18) is adapted to removably keep the magnetic element (22) in place.
3. A rod (20) according to claims 1 to 2, (20) wherein when the rod has the first width (W1) it has a first cross-section, and when the rod has the second width (W2) it has a second cross-section, wherein the shortest distance between the first and the second cross-sections is variable between a third length (x1) and a fourth length (x2).
4. A rod (20) according to any of the previous claims, wherein the rod (20) is deformable, wherein the shortest line passing through the rod and the two rod ends is not a straight line.
5. A rod (20) according to any of the previous claims, wherein the rod (20) is adapted so as to obtain foldable periodic structures.
6. A rod (20) according to claim 5, wherein a folding angle is formed between two consecutive folds in the foldable periodic structure.
7. A rod (20) according to claim 6, wherein the folding angle ranges between 0° and 180° degrees, preferably between 5° and 100°, and more preferably between 10° and 90°.
8. A construction toy (37), comprising:
at least two rods (20) according to claims 1 to 7.
9. A construction toy (37) according to claim 8, further comprising:
at least one magnetic connecting element (30), wherein the connecting element (30) is adapted to be attached magnetically to at least one rod end, wherein the connecting element (30) comprises partially or fully a north or a south pole or a combination thereof.
10. A construction toy (37) according to claim 8 to 9, wherein the fixing element (18) is adapted to complement in shape the connecting element (30).
11. A construction toy (37) according to claim 8 to 10, wherein the connecting element (30) has an ellipsoid configuration.
12. A method for producing a rod (20) according to claims 1 to 7, comprising the steps of:
- providing a rod (20) comprising two opposite ends, wherein the rod has a rod length and a rod width, wherein the width varies periodically between a first width (W1) and a second width (W2), wherein the ratio between the first and second widths (W1, W2) changes when varying the rod length,
- configuring the rod (20) to be of a variable length,
- providing a plurality of magnetic elements (22) of different polarities,
- configuring each end to removably receive one magnetic element (22), wherein each end comprises a cap (18) adapted to have at its end, at the side facing away from the rod, a spherical depression, and wherein the angle (θ) formed between the longitudinal axis of the rod and the surface of said spherical depression is between 30° and 60°.
13. A method for producing a construction toy (37), comprising the steps of:
- the method steps according to claim 12,
- providing a magnetic connecting element (30), wherein the connecting element (30) is adapted to be attached magnetically to at least one rod end.
14. A kit for constructing a rod (20) according to claims 1 to 7, comprising:
- at least one rod (20),
- a plurality of magnetic elements (22),
- a plurality of fixing elements (18), wherein each fixing element (18) is configured to fix one magnetic element (22) on one rod end.
15. A kit for constructing a construction toy (37), comprising:
- the kit according to claim 14,
- at least one magnetic connecting element (22),

wherein the connecting element (22) is adapted to be attached magnetically to at least one rod end.

Patentansprüche

1. Stab (20) für ein Konstruktionsspielzeug (37), zwei gegenüberliegende Enden umfassend, die um eine Stablänge voneinander beabstandet sind, wobei jedes Ende mit einem Magnelement (22) versehen ist, wobei sich der Stab (20) in einer Längsachse erstreckt, wobei der Stab (20) eine Stabbreite aufweist, wobei die Breite zwischen einer ersten Breite (W1) und einer zweiten Breite (W2) regelmäßig variiert, wobei sich das Verhältnis zwischen der ersten und der zweiten Breite (W1, W2) ändert, wenn die Stablänge variiert, und **dadurch gekennzeichnet, dass** jedes Ende eine Kappe (18) umfasst, die dafür eingerichtet ist, an ihrem Ende an der Seite, die von dem Stab weg weist, eine kugelförmige Vertiefung aufzuweisen, und wobei der Winkel (θ), der zwischen der Längsachse des Stabes und der Oberfläche der kugelförmigen Vertiefung gebildet ist, zwischen 30° und 60° beträgt.
2. Stab (20) nach Anspruch 1, wobei jedes Ende des Stabs (20) ein Befestigungselement (18) umfasst, wobei das Befestigungselement (18) dafür eingerichtet ist, das Magnelement (22) entnehmbar an Ort und Stelle zu halten.
3. Stab (20) nach den Ansprüchen 1 bis 2, wobei der Stab einen ersten Querschnitt aufweist, wenn er die erste Breite (W1) aufweist, und der Stab einen zweiten Querschnitt aufweist, wenn er die zweite Breite (W2) aufweist, wobei der kürzeste Abstand zwischen dem ersten und dem zweiten Querschnitt zwischen einer dritten Länge (x1) und einer vierten Länge (x2) variabel ist.
4. Stab (20) nach einem der vorhergehenden Ansprüche, wobei der Stab (20) verformbar ist, wobei die kürzeste Linie, die durch den Stab und die zwei Stabenden verläuft, keine gerade Linie ist.
5. Stab (20) nach einem der vorhergehenden Ansprüche, wobei der Stab (20) derart eingerichtet ist, dass er faltbare regelmäßige Strukturen erzielt.
6. Stab (20) nach Anspruch 5, wobei zwischen zwei aufeinanderfolgenden Falten in der faltbaren regelmäßigen Struktur ein Faltwinkel gebildet ist.
7. Stab (20) nach Anspruch 6, wobei der Faltwinkel im Bereich von 0° bis 180° liegt, vorzugsweise zwischen 5° und 100° und bevorzugter zwischen 10° und 90° .

8. Konstruktionsspielzeug (37), Folgendes umfassend:
mindestens zwei Stäbe (20) nach den Ansprüchen 1 bis 7.

9. Konstruktionsspielzeug (37) nach Anspruch 8, ferner Folgendes umfassend:

mindestens ein magnetisches Verbindungselement (30),
wobei das Verbindungselement (30) dafür eingerichtet ist, magnetisch an mindestens einem Stabende angebracht zu werden, wobei das Verbindungselement (30) teilweise oder vollständig einen Nord- oder einen Südpol oder eine Kombination daraus umfasst.

10. Konstruktionsspielzeug (37) nach Anspruch 8 bis 9, wobei das Befestigungselement (18) dafür eingerichtet ist, in seiner Form komplementär zu dem Verbindungselement (30) zu sein.

11. Konstruktionsspielzeug (37) nach Anspruch 8 bis 10, wobei das Verbindungselement (30) eine elliptische Gestaltung aufweist.

12. Verfahren zum Produzieren eines Stabes (20) nach den Ansprüchen 1 bis 7, die folgenden Schritte umfassend:

- Bereitstellen eines Stabes (20), der zwei gegenüberliegende Enden umfasst, wobei der Stab eine Stablänge und eine Stabbreite aufweist, wobei die Breite zwischen einer ersten Breite (W1) und einer zweiten Breite (W2) regelmäßig variiert, wobei sich das Verhältnis zwischen der ersten und der zweiten Breite (W1, W2) ändert, wenn die Stablänge variiert wird,
- Gestalten des Stabs (20) derart, dass er von variabler Länge ist,
- Bereitstellen mehrerer Magnelemente (22) mit unterschiedlichen Polaritäten,
- Gestalten jedes Endes derart, dass es ein Magnelement (22) entnehmbar aufnimmt, wobei jedes Ende eine Kappe (18) umfasst, die dafür eingerichtet ist, an ihrem Ende an der Seite, die von dem Stab weg weist, eine kugelförmige Vertiefung aufzuweisen, und wobei der Winkel (θ), der zwischen der Längsachse des Stabes und der Oberfläche der kugelförmigen Vertiefung gebildet ist, zwischen 30° und 60° beträgt.

13. Verfahren zum Produzieren eines Konstruktionsspielzeuges (37), die folgenden Schritte umfassend:

- die Verfahrensschritte nach Anspruch 12,
- Bereitstellen eines magnetischen Verbindungselements (30), wobei das Verbindungselement

lement (30) dafür eingerichtet ist, magnetisch an mindestens einem Stabende angebracht zu werden.

14. Bausatz zum Konstruieren eines Stabs (20) nach den Ansprüchen 1 bis 7, Folgendes umfassend:

- mindestens einen Stab (20),
- mehrere Magnetelemente (22),
- mehrere Befestigungselemente (18), wobei jedes Befestigungselement (18) dafür gestaltet ist, ein Magnetelement (22) an einem Stabende zu befestigen.

15. Bausatz zum Konstruieren eines Konstruktions-spielzeuges (37), Folgendes umfassend:

- den Bausatz nach Anspruch 14,
- mindestens ein magnetisches Verbindungselement (22), wobei das Verbindungselement (22) dafür eingerichtet ist, magnetisch an mindestens einem Stabende angebracht zu werden.

Revendications

1. Tige (20) pour un jouet de construction (37) comprenant deux extrémités opposées espacées l'une de l'autre par une longueur de tige, dans laquelle chaque extrémité est dotée d'un élément magnétique (22), dans laquelle la tige (20) s'étend dans un axe longitudinal, dans laquelle la tige (20) présente une largeur de tige, dans laquelle la largeur varie périodiquement entre une première largeur (W1) et une deuxième largeur (W2), dans laquelle le rapport entre les première et deuxième largeurs (W1, W2) change lors de la variation de la longueur de tige, et **caractérisée en ce que** chaque extrémité comprend un capuchon (18) adapté pour présenter au niveau de son extrémité, au niveau du côté opposé à la tige, une dépression sphérique, et dans laquelle l'angle (θ) formé entre l'axe longitudinal de la tige et la surface de ladite dépression sphérique est entre 30° et 60°.
2. Tige (20) selon la revendication 1, dans laquelle chaque extrémité de tige (20) comprend un élément de fixation (18), dans laquelle l'élément de fixation (18) est adapté pour maintenir de manière amovible l'élément magnétique (22) en place.
3. Tige (20) selon les revendications 1 à 2, dans laquelle lorsque la tige présente la première largeur (W1) elle présente une première section transversale, et lorsque la tige présente la deuxième largeur (W2) elle présente une deuxième section transversale, dans laquelle la distance la plus courte entre la pre-

mière et la deuxième section transversale est variable entre une troisième longueur (x1) et une quatrième longueur (x2).

4. Tige (20) selon l'une quelconque des revendications précédentes, dans laquelle la tige (20) est déformable, dans laquelle la ligne la plus courte passant à travers la tige et les deux extrémités de tige n'est pas une ligne droite.
5. Tige (20) selon l'une quelconque des revendications précédentes, dans laquelle la tige (20) est adaptée de façon à obtenir des structures périodiques pliables.
6. Tige (20) selon la revendication 5, dans laquelle un angle de pliage est formé entre deux plis consécutifs dans la structure périodique pliable.
7. Tige (20) selon la revendication 6, dans laquelle l'angle de pliage se situe dans une plage entre 0° et 180° degrés, de préférence entre 5° et 100°, et de manière davantage préférée entre 10° et 90°.
8. Jouet de construction (37), comprenant : au moins deux tiges (20) selon les revendications 1 à 7.
9. Jouet de construction (37) selon la revendication 8, comprenant en outre : au moins un élément de liaison (30) magnétique, dans lequel l'élément de liaison (30) est adapté pour être relié magnétiquement à au moins une extrémité de tige, dans lequel l'élément de liaison (30) comprend partiellement ou totalement un pôle nord ou sud ou une combinaison de ceux-ci.
10. Jouet de construction (37) selon la revendication 8 à 9, dans lequel l'élément de fixation (18) est adapté pour compléter en forme l'élément de liaison (30).
11. Jouet de construction (37) selon la revendication 8 à 10, dans lequel l'élément de liaison (30) présente une configuration ellipsoïdale.
12. Procédé de production d'une tige (20) selon les revendications 1 à 7, comprenant les étapes de :
 - fourniture d'une tige (20) comprenant deux extrémités opposées, dans lequel la tige présente une longueur de tige et une largeur de tige, dans lequel la largeur varie périodiquement entre une première largeur (W1) et une deuxième largeur (W2), dans lequel le rapport entre les première et deuxième largeurs (W1, W2) change lors de la variation de la longueur de tige,

- configuration de la tige (20) pour qu'elle soit d'une longueur variable,
 - fourniture d'une pluralité d'éléments magnétiques (22) de différentes polarités,
 - configuration de chaque extrémité pour qu'elle 5
reçoive de manière amovible un élément magnétique (22), dans lequel chaque extrémité comprend un capuchon (18) adapté pour présenter au niveau de son extrémité, au niveau du côté opposé à la tige, une dépression sphérique, 10
et dans lequel l'angle (θ) formé entre l'axe longitudinal de la tige et la surface de ladite dépression sphérique est entre 30° et 60°.
13. Procédé de production d'un jouet de construction 15
(37), comprenant les étapes de :
- les étapes de procédé selon la revendication 12,
 - fourniture d'un élément de liaison (30) magnétique, dans lequel l'élément de liaison (30) est 20
adapté pour être relié magnétiquement à au moins une extrémité de tige.
14. Kit pour construire une tige (20) selon les revendications 1 à 7, comprenant : 25
- au moins une tige (20),
 - une pluralité d'éléments magnétiques (22),
 - une pluralité d'éléments de fixation (18), dans 30
lequel chaque élément de fixation (18) est configuré pour fixer un élément magnétique (22) sur une extrémité de tige.
15. Kit pour construire un jouet de construction (37), 35
comprenant :
- le kit selon la revendication 14,
 - au moins un élément de liaison magnétique (22), dans lequel l'élément de liaison (22) est 40
adapté pour être relié magnétiquement à au moins une extrémité de tige.

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Fig. 1
-Prior Art-

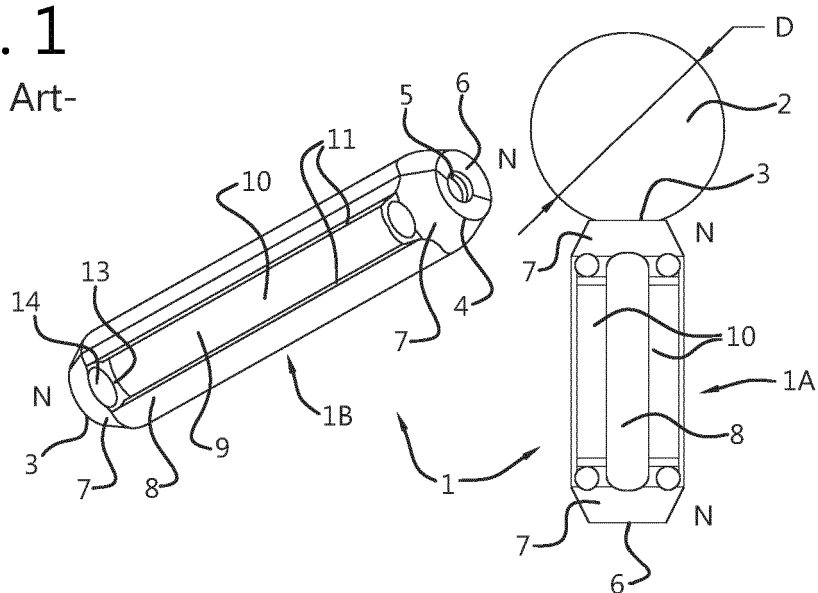


Fig. 2A

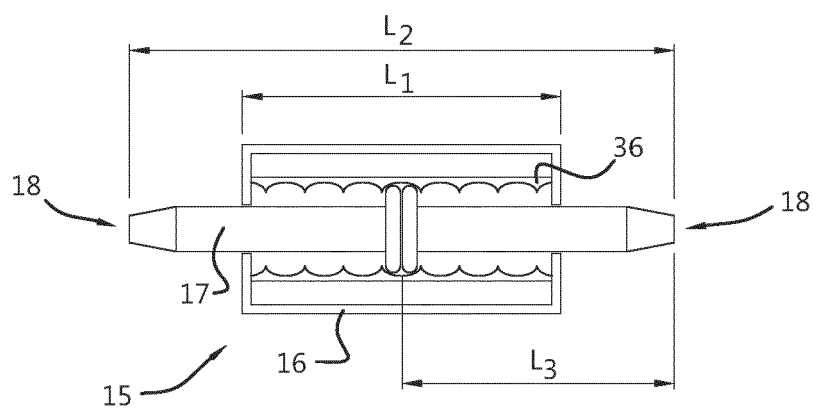


Fig. 2B

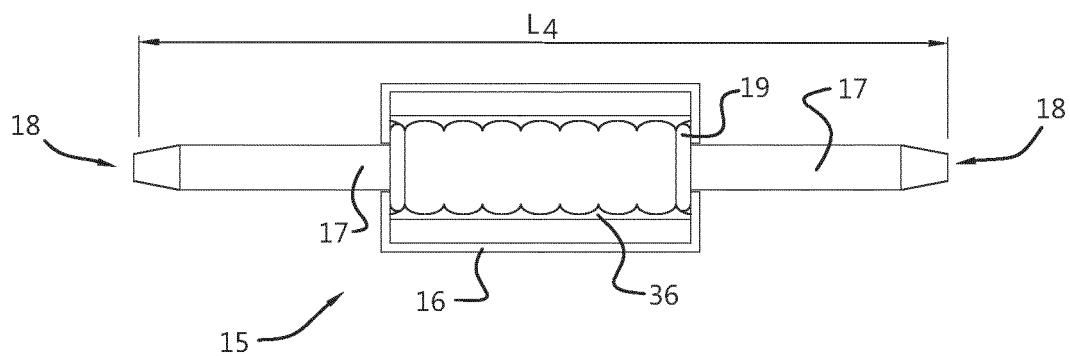


Fig. 3A

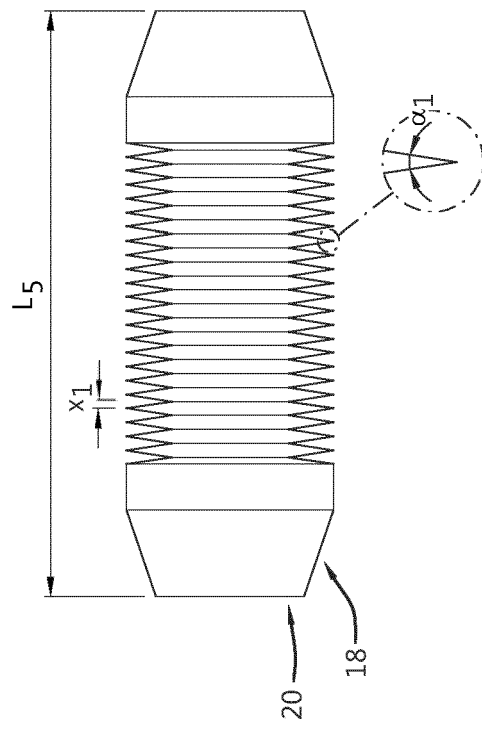


Fig. 3B

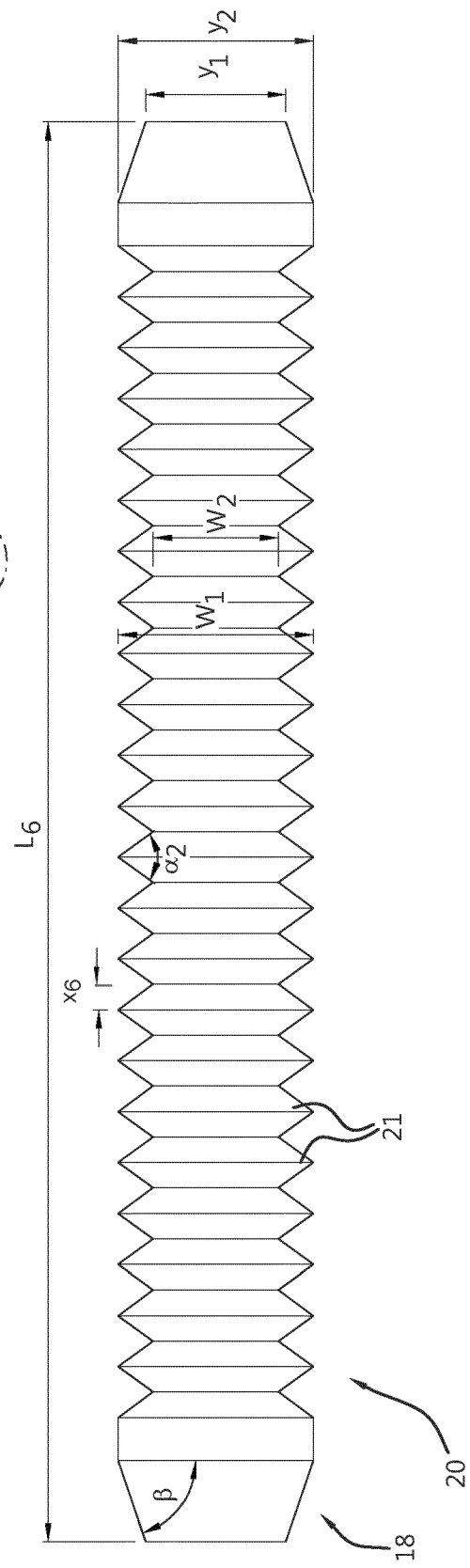


Fig. 4

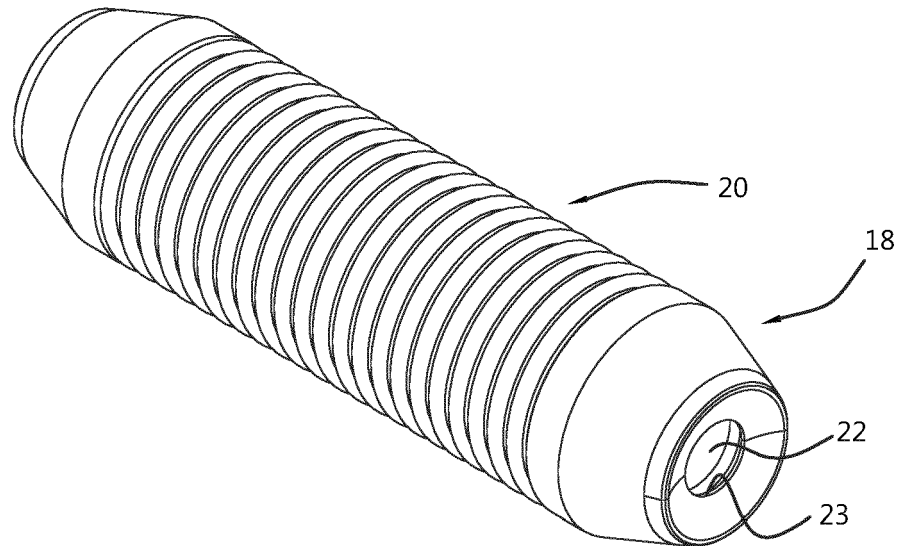


Fig. 5

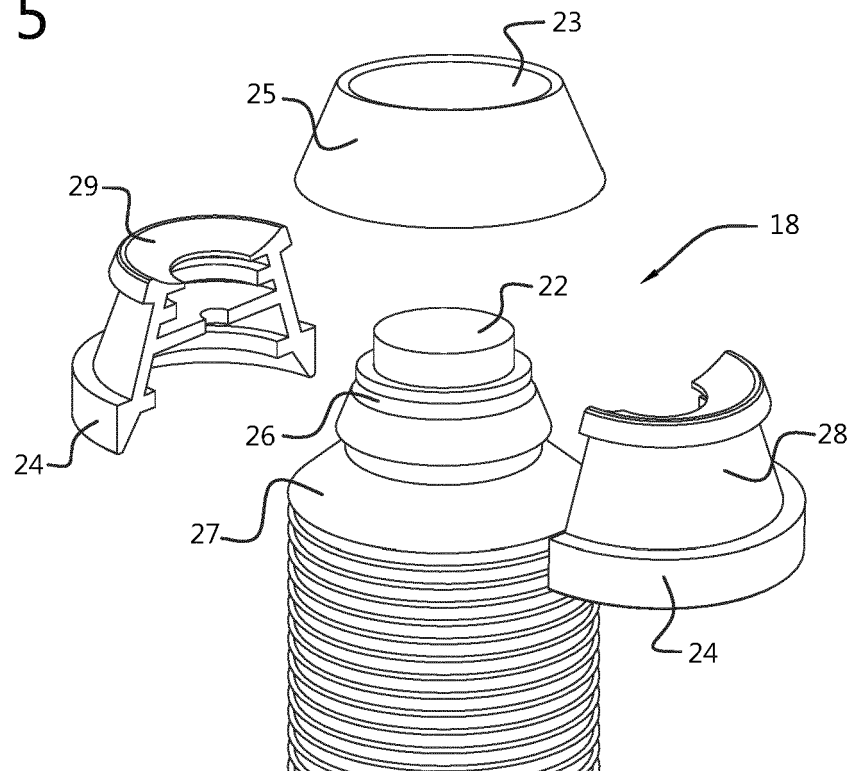


Fig. 6

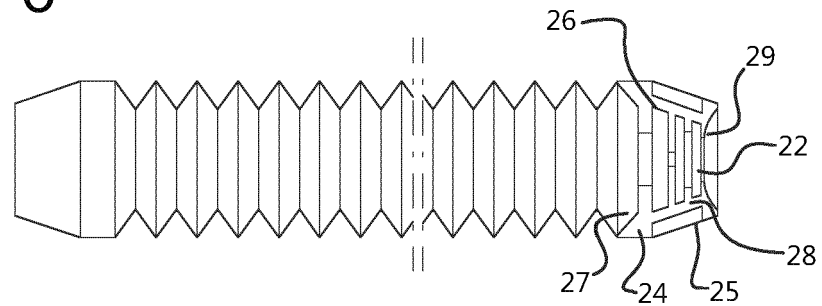


Fig. 7A

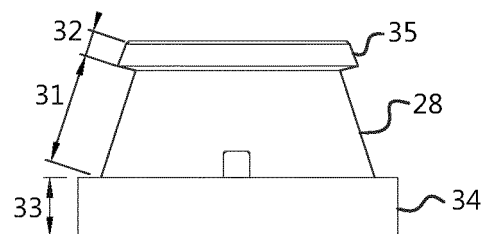


Fig. 7B

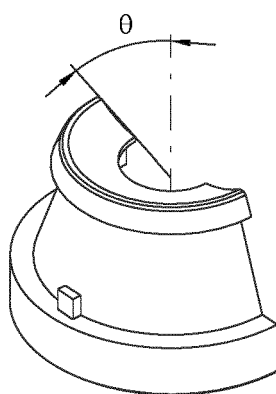


Fig. 7C

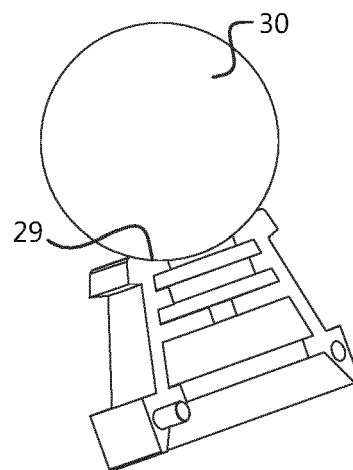


Fig. 8

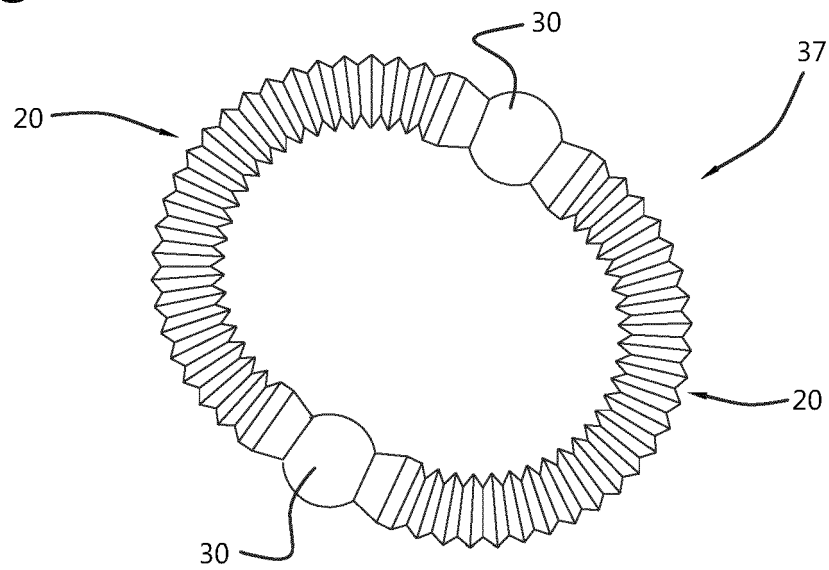
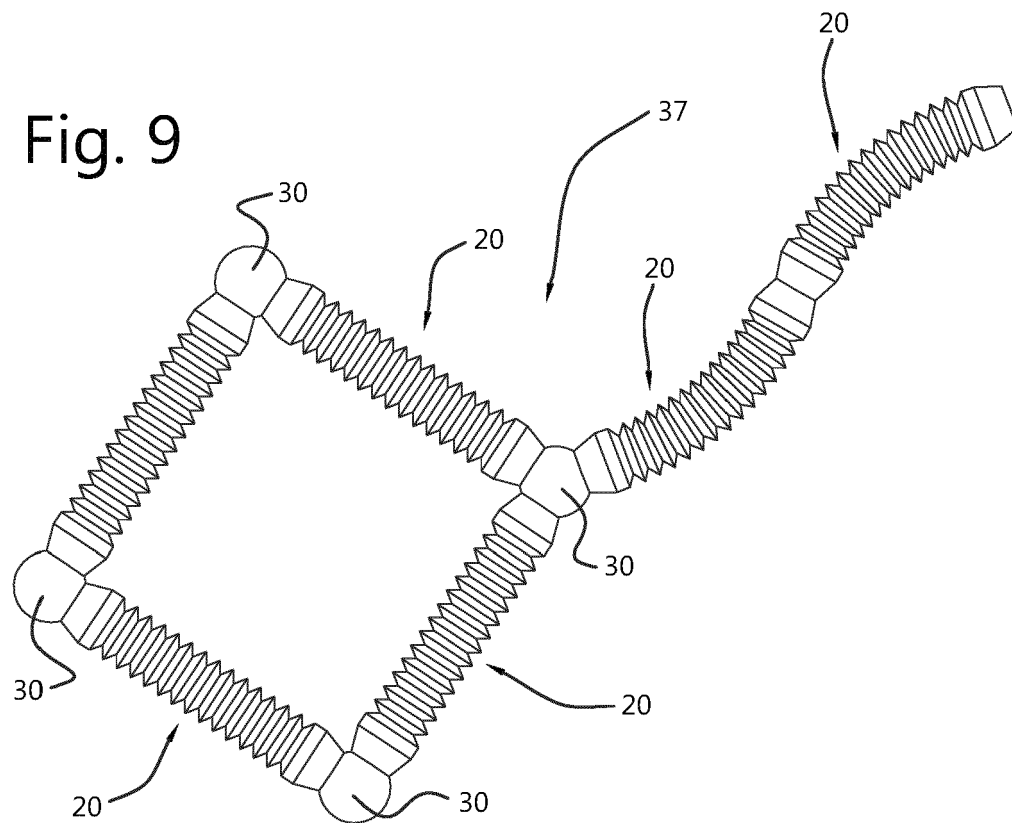


Fig. 9



REFERENCES CITED IN THE DESCRIPTION

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