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(71) Applicant: **Essen-Möller, Martin**
**129 42 Hägersten (SE)**

(72) Inventor: **Essen-Möller, Martin**
**129 42 Hägersten (SE)**

(74) Representative: **Zacco Sweden AB**
**P.O. Box 5581**
**Löjtnantsgatan 21**
**114 85 Stockholm (SE)**

# (54) MULTI-PURPOSE CONSTRUCTIONAL ELEMENTS, ARRANGEMENTS AND ASSEMBLY METHODS

(57) A multi-purpose constructional element, an arrangement comprising a plurality of such elements and a method for assembling such an arrangement are provided. The multi-purpose constructional element is configured to be connected to other constructional elements to form an elongated body with a rotational axis A. The constructional element is a form-locking element and comprises a centre portion, at least one protrusion extending from the centre portion, and at least one recess. The at least one protrusion is configured to interact with the at least one recess of another constructional element. The constructional element is configured so that, when connected to other constructional elements, only the last connected constructional element can be disconnected from the others.

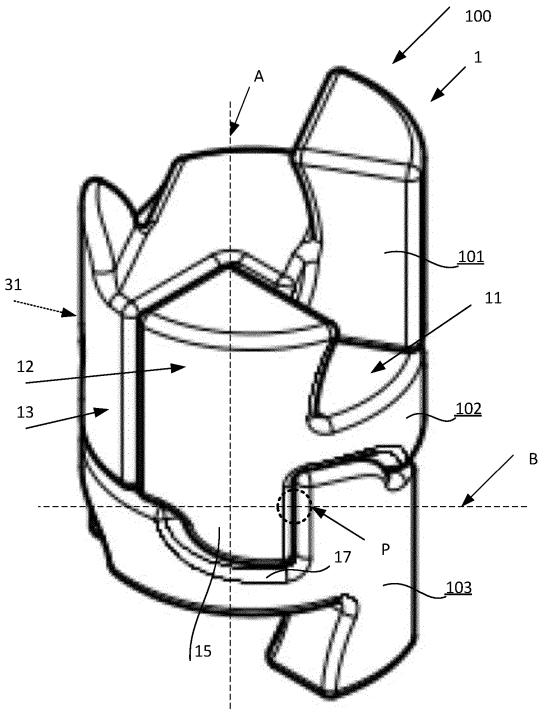


Fig. 4a

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## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a multi-purpose constructional element, arrangements formed by such elements and methods for assembling such arrangements. In particular, the present invention relates to a form-locking element.

**[0002]** The multi-purpose constructional element has various applications, such as constructional building blocks, toy blocks and puzzles, equipment for fine motor skills training and rehabilitation, collapsible or expandable structures such as poles and masts, etc.

### BACKGROUND ART

**[0003]** Constructional elements exist in various shapes and forms, and with different purposes.

**[0004]** Constructional building blocks, for example, are available in a wide range of shapes and forms. Such building blocks are often attached to each other in one direction, often vertically, depending on the intended use. In an assembled state, such blocks are able to withstand stresses and axial compression but are vulnerable to radial shearing and axial extraction, as well as stresses acting at an angle to the attachment direction. In order to support such building blocks, additional supporting means and/or fastening means are required.

**[0005]** Building blocks intended as toys lack actual load supporting abilities, since they are normally designed to support their own weight only and typically only in one direction. Furthermore, such toy blocks often lack practical applications and, even if increased in scale, are unsuitable as constructional elements. Furthermore, toy blocks are usually intended as either building blocks or puzzles, and do not provide for spatial reasoning training while simultaneously building a structure. When used in physical therapy or similar training for improving dexterity and fine motor skills, toy building blocks are generally limited to basic shapes that are only assembled and disassembled in linear movements.

**[0006]** Collapsible and extendible structures, such as telescopic structures, are convenient for use in temporary constructions such as tent poles and scaffolds. Such structures, however, tend to be limited in versatility. Detachable individual elements of extendible structures, for example, are often produced at fixed lengths that may be unsuitable for the application at hand. Furthermore, constructions consisting of detachable elements often lack in stability and therefore require additional fastening means to maintain stability and form, especially if the structure to be assembled is high or exposed to loads such as wind. Telescopic structures, where elements of gradually decreasing radii collapse into the outermost element, are restricted by the radius of the outermost element.

**[0007]** Thus, there exists a need for a versatile multi-purpose constructional element, which overcomes drawbacks of existing constructional elements.

### SUMMARY OF THE INVENTION

**[0008]** An object of the present invention is to achieve an advantageous constructional element, which is easily assembled and disassembled, structurally stable and able to withstand stresses while being easily scalable, manoeuvrable and transportable. Furthermore, an object of the present invention is to achieve a constructional element, which is resource efficient and reusable, user-friendly and cost-efficient.

**[0009]** The herein mentioned objects are achieved by a multi-purpose constructional element, an arrangement formed by such elements and a method for assembling such an arrangement, according to the independent claims.

**[0010]** Hence, according to an aspect of the present invention, a multi-purpose constructional element is provided, the multi-purpose constructional element being configured to be connected to other constructional elements to form an elongated body with a rotational axis A, wherein the constructional element is a form-locking element and comprises a centre portion, at least one protrusion extending from the centre portion, and at least one recess, wherein the at least one protrusion is configured to interact with the at least one recess of another constructional element, wherein the constructional element is configured so that, when connected to other constructional elements, only the last connected constructional element can be disconnected from the others.

**[0011]** According to another aspect of the invention, a constructional arrangement is provided, comprising a plurality of connected constructional elements as disclosed herein, wherein the constructional elements interlock to form an elongated body.

**[0012]** According to yet another aspect of the present invention, a method is provided for assembling an arrangement as disclosed herein, the method comprising connecting the constructional elements sequentially.

**[0013]** By means of its configuration, the multi-purpose constructional element according to the present invention provides an effective form-lock when attached to other constructional elements of the same type. Furthermore, the multi-purpose constructional element according to the present invention is easily scalable, manoeuvrable, reusable, resource efficient and transportable.

**[0014]** When a plurality of the multi-purpose constructional elements according to the present invention are connected, an advantageous constructional arrangement is obtained, which is easily assembled and disassembled. In addition, a constructional arrangement that is structurally stable and able to withstand stresses is achieved, which is at the same time easily scalable, manoeuvrable and transportable. Furthermore, a constructional arrangement, which is resource efficient, reusable, user-friendly and cost-efficient, is attained.

**[0015]** In addition, the method for assembling the constructional arrangement as disclosed herein, where the constructional elements are connected sequentially, provides for an effective assembly method that is possible to perform both manually and automatically.

**[0016]** Further objects, advantages and novel features of the present invention will become apparent to one skilled in the art from the following details, and also by putting the invention into practice. Whereas the invention is described below, it should be noted that it is not restricted to the specific details described. Specialists having access to the teachings herein will recognise further applications, modifications and incorporations within other fields, which are within the scope of the invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0017]** For a more complete understanding of the present disclosure and further objects and advantages of it, the detailed description set out below should be read together with the accompanying drawings, in which the same reference signs denote similar items in the various drawings, and in which:

| | |
|---|---|
| Figures 1a-d | schematically illustrate a multi-purpose constructional element according to an example; |
| Figures 2a-d | schematically illustrate a multi-purpose constructional element according to an example; |
| Figures 2e | schematically illustrates two connected multi-purpose constructional elements according to an example; |
| Figure 3 | schematically illustrates a method for assembling a constructional arrangement according to an example; |
| Figure 4a | schematically illustrates a constructional arrangement according to an example; |
| Figure 4b | schematically illustrates a method for assembling a constructional arrangement according to an example; |
| Figure 5a | schematically illustrates a constructional arrangement according to an example; and |
| Figure 5b | schematically illustrates a method for assembling a constructional arrangement according to an example. |

## DETAILED DESCRIPTION

**[0018]** The present disclosure will now be described in further detail below. It is to be understood that all the various examples of the multi-purpose constructional element also apply for the constructional arrangement comprising a plurality of such constructional elements, and vice versa. The same applies for the method for assembling such a constructional arrangement.

**[0019]** To achieve an improved, scalable, manoeuvrable, reusable, resource efficient and transportable constructional element, a multi-purpose constructional element according to the present disclosure has been developed. The present disclosure is applicable on all sorts of constructional elements configured to be connected to identical or similar elements. The present disclosure is applicable in all sorts of constructional arrangements, such as constructional building blocks, toy blocks and puzzles, equipment for fine motor skills training and rehabilitation, collapsible or expandable structures such as poles and masts, etc. The methods of the present disclosure are applicable in various contexts where constructional arrangements are assembled, either manually or automatically by means of a machine such as an industrial robot.

**[0020]** Hence, according to an aspect of the present disclosure, a multi-purpose constructional element is provided. The multi-purpose constructional element is configured be connected to other constructional elements to form an elongated body with a rotational axis A. The constructional element is a form-locking element and comprises a centre portion, at least one protrusion extending from the centre portion, and at least one recess. The at least one protrusion is configured to interact with the at least one recess of another constructional element. The constructional element is configured so that, when connected to other constructional elements, only the last connected constructional element can be disconnected from the others. Thus, if the elements are assembled from top to bottom, forming an elongated body with a rotational axis A, only the element at the bottom of the structure can be disconnected, since all the other elements in the structure are locked to each other by means of the form-locking configuration of the constructional elements. The constructional element may also be referred to as a form-locking element. Herein, the term "form-locking" is used to describe elements that interlock and thereby restrict movement, as a consequence of their respective shapes, i.e. no external fasteners or adhesives are needed to connect the constructional elements. In one example, when three elements are assembled in sequence, only the third element, which was attached last in the sequence, can be disconnected from the other two. The constructional element may extend longitudinally along a longitudinal axis L. The multi-purpose constructional element may be configured to be connected to other identical or similar constructional elements. The multi-purpose constructional element may

be configured to be connected to other constructional elements of the same type. Herein, the expression "constructional elements of the same type" is used to indicate that constructional elements of "the same type" are intended to fit together, i.e. no alteration needs to be made in order to connect the constructional elements in an interlocking, and/or form-locking, relationship. Thus, it is well within the concept of the present disclosure that the constructional elements may differ in shape while remaining compatible in the essential features that interlock or connect them. Such constructional elements are thus to be considered "similar" to each other and/or "of the same type".

**[0021]** According to an aspect of the present invention, a multi-purpose constructional element is provided, the multi-purpose constructional element being configured to be connected to other constructional elements to form a cylindrical body with a rotational axis A, wherein the constructional element is a form-locking element and comprises a centre portion, at least one protrusion extending from the centre portion, and at least one recess, wherein the at least one protrusion is configured to interact with the at least one recess of another constructional element, wherein the constructional element is configured so that, when connected to other constructional elements, only the last connected constructional element can be disconnected from the others. Thus, if the elements are assembled from top to bottom in a cylinder shape with a rotational axis A, only the element at the bottom of the structure can be disconnected, since all the other elements in the structure are locked to each other by means of the form-locking configuration of the constructional elements. The centre portion may be configured to form part of the envelope surface of the cylindrical body formed by constructional elements. The multi-purpose constructional element may be configured to be connected to other identical or similar constructional elements. The multi-purpose constructional element may be configured to be connected to other constructional elements of the same type.

**[0022]** The elongated body formed by the constructional elements may thus have a circular cross-section. Alternatively, the elongated body formed by the constructional elements may have a polygon shaped cross-section. The elongated body may thus have the shape of a polygonal prism. In other words, the elongated body may be configured with various cross-sections, such as circular, elliptical or n-sided polygonal. Furthermore, the elongated body may be configured with various bases, such as a circular, an elliptical or an n-sided polygonal base. The elongated body may be a polyhedron, such as a prism with an n-sided polygon base. In addition, the cross-section may vary within the elongated body such that the cross-section may, for example, be circular at one section of the elongated body and elliptical or polygonal at another section.

**[0023]** The constructional element may be configured to be connected to another constructional element by pivoting the constructional element about a pivot axis B arranged at an angle to the rotational axis A. The constructional element may be configured to be connected to another constructional element by pivoting the constructional element about a pivot axis B essentially perpendicular to the rotational axis A. In other words, a first element may be connected to a second element by pivoting either the first or the second element about a pivot axis B, which may be essentially perpendicular to the rotational axis A. When connecting the constructional element to other identical or similar constructional elements to form an elongated body with a rotational axis A, a longitudinal central axis L of the element may be brought into alignment with the rotational axis A. Alternatively, when connecting the constructional element to other identical or similar constructional elements to form an elongated body with a rotational axis A, a longitudinal central axis L of the element may be become parallel with the rotational axis A. Similarly, the constructional element may be configured to be disconnected from another constructional element by pivoting the constructional element about pivot axis B in opposite direction compared to when connecting it.

**[0024]** The constructional element may be configured such that the constructional element, when connected to other constructional elements, interlocks at least two previously connected constructional elements. By way of its configuration, each element has the capacity to interlock at least two other constructional elements, thereby achieving a form-lock between the two interlocked elements as well as achieving a form-lock between the two interlocked elements and itself. Such a configuration provides stability to the structure that is formed by connecting the elements, e.g. by enabling it to withstand forces acting upon it in all directions.

**[0025]** The constructional element may comprise a first protrusion and a second protrusion, extending from the centre portion in a first direction respectively a second direction, wherein the first protrusion is configured to interact with one adjacent constructional element and the second protrusion is configured to interact with another adjacent constructional element. Thus, the constructional element may interlock with one adjacent constructional element by means of the first protrusion, and interlock with another adjacent constructional element by means of the second protrusion. Thereby, increased stability is provided to the structure. In addition, through such a configuration of the constructional elements, only one type of unit is needed to form a structure. Thus, the constructional element is resource efficient, reusable, user-friendly and cost-efficient

**[0026]** The centre portion may comprises two opposite surfaces that are substantially flat and parallel. The surfaces may be referred to as a top surface and a bottom surface. The centre portion may further comprise an envelope surface, or cylinder surface, curved around the longitudinal axis L.

**[0027]** The constructional element may be configured

such that two adjacent connected elements together form a cavity configured to receive a protrusion of another adjacent element and thereby prevent disconnection of the two adjacent elements forming the cavity. When the protrusion of the third element mates with the formed cavity, pivotal movement of the two adjacent elements is effectively blocked so that the two adjacent elements no longer can be separated. This way, only the last connected constructional element can be disconnected from the others. Thus, a robust form-locking effect is achieved when the protrusion of another adjacent element is received in the cavity formed by two adjacent connected elements, enabling the three elements to interlock. Such a configuration provides stability, since it may resist both angular movements (e.g., rotational movements in a circumferential direction), straight movements (such as up, down or to toward a side), as well as pivoting movements about a pivot axis.

**[0028]** The constructional element may be configured to be connected to at least two other constructional elements to form a self-supported solid cylindrical body. Such a cylindrical body has various applications in all fields where an elongated unit is to be assembled, where the elongated unit needs to be readily assembled and disassembled. The length of such a cylindrical body is easily adjusted. In addition, constructional elements configured to form such a self-supported solid cylindrical body are particularly useful as constructional building blocks for constructing collapsible or expandable structures, such as poles and masts.

**[0029]** The self-supported solid cylindrical body formed by the constructional elements according to this example may be particularly useful in settings where an elongated structure can only be assembled from one direction. Such settings may include various fields such as arboriculture, scaffold construction, rescue work such as firefighting, and even deep sea and outer space technology. Furthermore, the formation of the self-supported cylindrical body improves the utility of the constructional elements as toy building blocks and tools for dexterity training, since the constructional elements in the cylinder remain attached to each other when an additional constructional element is added to the structure.

**[0030]** The constructional arrangements may be assembled either manually or automatically, e.g. by means of a machine such as an industrial robot, to form the self-supported solid cylindrical body.

**[0031]** The first protrusion and the second protrusion may, in this example, extend in opposite directions, essentially perpendicularly from the centre portion. The first protrusion may extend from the first surface and the second protrusion may extend from the second surface of the centre portion.

**[0032]** The first protrusion may comprise a plurality of surfaces. The second protrusion may comprise a plurality of surfaces.

**[0033]** The centre portion may further comprise a V-shaped projection, extending from the top surface to the bottom surface of the centre portion. The V-shaped projection comprises a first and a second convexly shaped surface, extending obliquely from the top surface to the bottom surface of the centre portion. The first surface of the V-shaped projection of a constructional element may be configured to provide a sliding surface for the first protrusion of another constructional element. The first surface of the V-shaped projection of one constructional element may thus be configured to abut the first protrusion of another constructional element. The second surface of the V-shaped projection may be configured to provide a sliding surface for a second protrusion of another constructional element. The second surface of the V-shaped projection may, thus, be configured to abut a second protrusion of another constructional element.

**[0034]** The constructional element may further comprise two pivot parts extending from the centre portion in opposite directions; and two pivot recesses arranged on opposite sides of the centre portion, wherein the pivot recesses are each configured to engage with a pivot part of different adjacent constructional elements. The pivot parts may be essentially identical in shape. The pivot recesses may be essentially identical in shape. The pivot parts may be convex and, thus, may correspond to the first and second pivot recesses, which may be concave. By way of example, the pivot parts may engage with the pivot recesses of another constructional element by pivoting the element about the pivot axis B perpendicular to the longitudinal axis A. Furthermore, when a pivot part of one constructional element engages the pivot recess of an adjacent constructional element, the pivot recess provides support and guidance for the pivot part. Advantageously, the placement of the pivot recesses on opposite sides of the centre portion allows for a versatile constructional element that may be arranged either above or below another element. The elements needed to form the self-supported solid cylindrical body, therefore, do not need to be arranged in a particular order in relation to each other, i.e. the elements do not have particular places in the sequence (such as first, second, third) when assembling an arrangement. Consequently, the constructional element is user-friendly in that individual elements do not need to be numbered or sorted prior to connecting them. In addition, the constructional element is easily transportable as well as cost-efficient to produce.

**[0035]** The at least one recess of the constructional element may be referred to as a first receiving recess. The centre portion of the constructional element may comprise the first receiving recess, which is configured to receive a first protrusion of an adjacent constructional element such that a first surface of the centre portion of the constructional element is in level with a top surface of the first protrusion of the adjacent constructional element.

**[0036]** The first receiving recess may be formed between the V-shaped projection and the part of the centre portion that forms the base for the second protrusion. The first receiving recess may be configured to receive

the first protrusion of an adjacent constructional element, such that the first, or top, surface of the centre portion of the constructional element is in level with a top surface of the first protrusion of the second constructional element. Such a configuration facilitates the formation of a solid cylinder, since the centre portion of another constructional element may rest against a level surface, when arranged directly above or below the two adjacent constructional elements.

**[0037]** A second receiving recess may be formed between the V-shaped projection and the part of the centre portion that forms the base for the first protrusion. The second receiving recess may be configured to receive the second protrusion of an adjacent constructional element.

**[0038]** The second protrusion of a first constructional element, arranged side-by-side with the V-shaped projection of a second constructional element, may form a cavity that interacts with the first protrusion of yet another constructional element. Thus, the first protrusion of a third constructional element may be inserted into the cavity that is formed when a first and a second constructional element are connected. Thereby, the first protrusion of a third constructional element may be inserted into the cavity by sliding its first protrusion against the second protrusion of the first constructional element, joined with the first surface of the V-shaped projection of the second constructional element.

**[0039]** The constructional element may be configured to form part of a self-supported hollow cylindrical body.

**[0040]** Such a self-supported hollow cylindrical body may be used in all sorts of constructional arrangements, such as constructional building blocks, toy blocks and puzzles, equipment for fine motor skills training and rehabilitation, collapsible or expandable structures such as poles and masts, etc. In particular, the self-supported hollow cylindrical body provides an improved protective sleeve or sheath for cables and/or pipes.

**[0041]** Protective sleeves and sheathes for cables and pipes are generally produced in long units, which are either cut off in situ or pre-cut together with the pipe or cable during manufacture. Thus, such sleeves and sheaths lack in versatility and often require tools for cutting. Unnecessary material may therefore be transported to a site, often requiring special transportation. On site, much material is wasted due to adaptations. Furthermore, known sheathes and sleeves for pipes and cables are difficult to disassemble and are rarely reusable. A constructional arrangement according to the present disclosure overcomes these drawbacks, in particular if the constructional arrangement is a self-supported hollow cylindrical body formed by a plurality of constructional elements as disclosed herein.

**[0042]** The constructional element may comprise a first protrusion configured to interact with two previously connected constructional elements, wherein the first protrusion is configured to form part of an inner surface of the hollow cylindrical body formed by the constructional elements.

**[0043]** The first protrusion may extend essentially perpendicularly from the first, or top, surface of the centre portion in a longitudinal, or upward, direction. However, the first protrusion may curve slightly towards the envelope surface of the centre portion. The first protrusion may be configured with a somewhat V-shaped cross section in order to enable interaction with two previously connected constructional elements.

**[0044]** The constructional element may further comprise a second protrusion with a hook portion, configured to engage with the at least one recess of an adjacent constructional element. The second protrusion of the constructional element may extend perpendicularly from the centre portion in a lateral, or sideways, direction. The bottom surface of the hook portion may be somewhat curved and extends radially inwards. The shape of the hook portion corresponds to the shape of a first pivot recess of an adjacent constructional element. The second protrusion, in an example, may also constitute a pivot part.

**[0045]** In an example, a pivot part may extend essentially perpendicularly to, and in a downward direction from, the first, or top, surface of the centre portion. The pivot part may comprise an envelope, or cylinder, surface, which is curved around the longitudinal axis L. The pivot part may be configured to engage with a second pivot recess of another constructional element. The second pivot recess may be formed between the hook portion of the second protrusion and the centre portion. The shape of the pivot part may correspond to the shape of the second pivot recess. The pivot part may comprise a convex pivot surface, which corresponds to a concave surface of the second pivot recess. The constructional element may further comprise a first pivot recess, which may be slightly L-shaped and arranged below and to the side of the pivot part. The shape of the first pivot recess corresponds to the shape of the hook portion.

**[0046]** In an example, the first receiving recess may be formed at the inner surface of the constructional element.

**[0047]** In an example, the constructional element comprises a second receiving recess. The second receiving recess may be formed at an inner surface of the constructional element. The second receiving recess may be configured to interact with the first protrusion of another constructional element. The first receiving recess of one constructional element and the second receiving recess of a second constructional element may together form a cavity, configured to receive the first protrusion of a third constructional element. The cavity may be shaped correspondingly to the V-shape of the first protrusion of the constructional element.

**[0048]** The envelope surfaces of the centre portion, the pivot part and the second protrusion may together form part of the envelope surface of the self-supported hollow cylindrical body, when connected to other constructional elements in an arrangement.

**[0049]** According to another aspect of the present disclosure, a constructional arrangement is provided. The constructional arrangement comprises a plurality of connected constructional elements as disclosed herein, wherein the constructional elements interlock to form an elongated body.

**[0050]** According to another aspect of the present disclosure, the constructional arrangement may comprise a plurality of connected constructional elements as disclosed herein, wherein the constructional elements interlock to form a cylindrical body.

**[0051]** The elongated body formed by the constructional elements may thus have a circular cross-section. Alternatively, the elongated body formed by the constructional elements may have a polygon shaped cross-section. The elongated body may thus have the shape of a polygonal prism. In other words, the elongated body may be configured with various cross-sections, such as circular, elliptical or n-sided polygonal. Furthermore, the elongated body may be configured with various bases, such as a circular, an elliptical or an n-sided polygonal base. The elongated body may be a polyhedron, such as a prism with an n-sided polygon base. In addition, the cross-section may vary within the elongated body such that the cross-section may, for example, be circular at one section of the elongated body and elliptical or polygonal at another section.

**[0052]** The constructional arrangement may comprise at least three constructional elements, such as a first, a second and a third constructional element, which are all of the same type. The constructional elements may be essentially identical. The constructional elements may be placed in any suitable order in the constructional arrangement.

**[0053]** Each constructional element may be displaced angularly in relation to the other elements. In one example, the angular displacement may advantageously be about 120 degrees. In another example, the angular displacement may advantageously be about 57 degrees. Each constructional element may be pivoted about the pivot axis B into engagement with the other constructional elements in the arrangement.

**[0054]** As a consequence of the form-locking effect achieved, three constructional elements may form a self-supported solid cylindrical body when joined together. In such an example, once at least three constructional elements are joined together, only the last attached element is removable.

**[0055]** In another example, a constructional arrangement may comprise at least seven interlocking constructional elements to form a self-supported hollow cylindrical body. Such a hollow cylindrical body may also be referred to as a tube. The constructional arrangement according to the example may comprise a first, second, third, fourth, fifth, sixth, and seventh constructional element. The constructional elements of the arrangement may be of the same type, and may be assembled in any suitable order in the arrangement. The constructional elements may be essentially identical. A self-supporting hollow cylindrical body may be achieved when the seventh constructional element is connected to the previous six connected elements.

**[0056]** According to an example, a plurality of constructional elements may be pre-connected to form a starting segment for the arrangement. Individual elements may then be sequentially connected to the starting segment. Alternatively or additionally, a starting segment may be provided, which mimics the essential shapes of at least six interlocked constructional elements. By way of example, if a starting segment is provided, the constructional arrangement may be assembled using the starting segment and any desirable number of constructional elements.

**[0057]** The starting segment may further comprise an attachment, for example a utility part such as a hook or grapple. Alternatively or additionally, the starting segment may be configured to be connected to a tool or other extension, for example by providing it with connecting means such as screw threads or snap action features.

**[0058]** The constructional elements in the arrangement may be connected by means of the first pivot part of one constructional element, which engages the second pivot recess of another constructional element. The first pivot recess of the constructional element may be arranged to receive the second protrusion of another constructional element. The first pivot part of a constructional element may engage with the hook portion of another constructional element, in a form-fit manner. The surfaces of the first and second pivot recesses may provide sliding surfaces that enable two adjacent elements to be pivoted into a lateral connection.

**[0059]** Furthermore, in an example, one constructional element may be connected to another constructional element by means of the first protrusion, which may engage the correspondingly shaped receiving recess of the other constructional element.

**[0060]** According to yet another aspect of the present disclosure, a method for assembling an arrangement as disclosed herein is provided. The method comprises connecting the constructional elements sequentially. The method may be performed manually or automatically by means of a machine, such as an industrial robot.

**[0061]** As an example, a second constructional element may be connected to a first constructional element, and thereafter, a third constructional element may be connected to the first and second constructional elements. Thereafter, any desirable number of constructional elements may be added to the arrangement.

**[0062]** The constructional elements may be assembled according to the principle of last in, first out. This means that the constructional element that was attached last when assembling an arrangement is the element that must be removed first when disassembling the arrangement.

**[0063]** Each additional constructional element may lock the connection between, at least, two previously con-

nected constructional elements. Thus, disassembling the arrangement may be performed by removing the latest attached constructional element, thereby unlocking the connection between the two previously connected constructional elements.

**[0064]** In an example, the latest attached constructional element in an assembled arrangement may be further secured to the other constructional elements of the arrangement by means of a fastener.

**[0065]** According to some embodiments of the present disclosure, the step of connecting the constructional elements sequentially may comprise, for each consecutive constructional element, arranging the constructional element angularly displaced about the rotational axis A in relation to the other constructional element(s), and pivoting the constructional element about a pivot axis B, perpendicular to the rotational axis A, to connect the constructional element to at least the previous constructional element in the sequence.

**[0066]** In other words, two elements to be connected may be angularly displaced in relation to each other, e.g., by rotation about the rotational axis A. In an example, the angular displacement may be about 120 degrees. In another example, the angular displacement may be about 57 degrees.

**[0067]** After having angularly displaced at least one element, the constructional element to be connected may be pivoted and thereby attached to the previous constructional element in the arrangement. In an example where two constructional elements are to be connected, the longitudinal axes L of the two constructional elements align when one of the constructional elements has been pivoted about the pivot axis B. Furthermore, in an assembled state, the respective longitudinal axes L of the constructional elements may coincide with the rotational axis A of the arrangement. In another example where two constructional elements are to be connected, the longitudinal axes L of the two constructional elements become parallel when one of the constructional elements has been pivoted about the pivot axis B. Furthermore, in an assembled state, the respective longitudinal axes L of the constructional elements are essentially parallel with the rotational axis A of the arrangement.

**[0068]** According to an example of the method for assembling an arrangement, the first pivot part of a first constructional element may be inserted into a first pivot recess of a second constructional element, in order to join the first and second constructional elements. The pivot part may be inserted at an angle, such that the second constructional element may be pivoted around the pivot axis B.

**[0069]** In an example where two constructional elements are to be connected, the first protrusion of one constructional element meets the receiving recess of the other constructional element. When the two constructional elements are being connected, the V-shaped projection of one element may be brought into engagement the first protrusion of another constructional element. The receiving recess of one constructional element may thus receive the first protrusion of the other constructional element. At the same time, the second, or bottom, surface of the centre portion of one constructional element may abut the first, or top, surface of the centre portion of the other constructional element.

**[0070]** In an example, adding a third constructional element to two previously connected constructional elements may form a self-supported solid cylindrical body by means of the form-locking effect achieved by the configuration of the constructional elements.

**[0071]** The third constructional element may be connected to the two previously connected constructional elements by applying the same rotational and pivoting movements as described above. For example, the first pivot part of the second constructional element may be inserted into the first pivot recess of the third constructional element. The pivot part may be inserted at an angle, such that the third constructional element may be pivoted about the pivot axis B.

**[0072]** In such an example, the first protrusion of the third constructional element connects with the receiving recess of the first constructional element as well as with the second protrusion of the second constructional element. Thus, when the third constructional element is pivoted about the pivot axis B, the first protrusion of the third constructional element may be inserted into a cavity formed by the first and second constructional elements, and slid against the V-shaped projection of the second constructional element as well as the second protrusion of the first constructional element. The insertion of the first protrusion of the third constructional element into the cavity may be said to complete the formation of a solid cylindrical body, thereby achieving the form-locking effect. Thus, in such an example, when the third constructional element is connected to the first and second constructional elements, only the third constructional element may be disconnected from the arrangement. This is consistent with the principle of first in - last out, since the third constructional element, which was connected last, is the constructional element that must be disconnected first, in order to disassemble the arrangement.

**[0073]** Additional constructional elements may be added to the arrangement, by repeating aspects of the method procedure described above.

**[0074]** In another example, a second constructional element, after having been rotated, may be brought into contact with a first constructional element at a pivot point and pivoted about the pivot axis B. When the second constructional element is pivoted about the axis B, the second protrusion of the second constructional element will engage the correspondingly shaped first pivot recess of the first constructional element. Additionally, the second pivot recess of the second constructional element will engage the first pivot part of the first constructional element. A lateral connection between the two constructional elements has been achieved when the respective parts of the constructional elements have been brought

into engagement. In this example, additional constructional elements may be sequentially connected, laterally, in the same manner as described for the first and second constructional elements.

**[0075]** According to an example, after having assembled six constructional elements, a seventh constructional element may be connected to the structure. Adding the seventh constructional element may achieve a more stable and robust form-locking effect between the assembled constructional elements.

**[0076]** When brought into contact with the previously attached adjacent constructional element and pivoted about the pivot axis B, the seventh constructional element may engage and interlock two other constructional elements, such as e.g., the first and sixth constructional elements in the assembly sequence. In such an example, the seventh and sixth constructional elements may connect laterally in the manner described above, while the seventh and first constructional elements may connect vertically. The seventh and first constructional elements may be connected via the first protrusion of the seventh constructional element, which engages the correspondingly shaped receiving recess of the first constructional element. By repeating the procedure described for joining the seventh constructional element, additional constructional elements may be added to the arrangement.

**[0077]** In an example, adding an eighth constructional element to an assembly of seven previously connected constructional elements not only connects the eighth element to the structure but also further interlocks the first, second and seventh constructional elements in such an arrangement (assuming the constructional elements are assembled sequentially starting with the first constructional element). Thus, the stability of the self-supported hollow cylindrical body may be secured through enhancing the inter-locking affect. Whereas the seventh constructional element may interlock with two previously connected adjacent constructional elements in the arrangement, the eighth constructional element, and all consecutive elements added thereafter, may interlock three previously connected adjacent constructional elements. In such an example, only the eighth constructional element may be disconnected from the other elements when the arrangement has been assembled, which is in line with the principle of last in, first out, since the eighth element was connected last.

**[0078]** The present disclosure will now be further illustrated with reference to the appended figures, wherein, for the sake of clarity and understanding of the disclosure, some details of the invention are omitted. Moreover, the figures shall not be considered drawn to scale as some features may be exaggerated in order to illustrate the disclosure more clearly. In the figures, some preferred examples of the present disclosure are shown. The invention may, however, be embodied in other forms and should not be construed as limited to the herein disclosed examples. The constructional elements described below may, for example, be configured in different ways and comprise fewer, additional and/or different features than the ones described below. Furthermore, the below described arrangements may comprise more, fewer or differently configured constructional elements. Correspondingly, the below described methods may be varied, for example by altering the assembly sequence, by adding more or fewer elements to an arrangement, and/or adding elements of other configurations than the ones exemplified.

**[0079]** Figures 1a-d schematically illustrate a multipurpose constructional element 1 according to an example. Directions, orientations and perspectives, such as top, bottom, side, rear and front, are used herein to facilitate understanding of the constructional element 1. Such terms are merely used as explanatory terms for describing the features of the constructional element 1 in relation to each other. Therefore, the use of such terms in no way restricts the configuration of the constructional element 1.

**[0080]** The constructional element 1 is depicted in figures 1a-d, as seen from the top in Fig. 1a, from the bottom in Fig. 1b, from the side in Fig. 1c, and from another side in Fig. 1d.

**[0081]** The constructional element 1, shown in Figures 1a-d, comprises a centre portion 11, a first protrusion 12, a second protrusion 13, a first receiving recess 14, a first pivot part 15, a second pivot part 16, a first pivot recess 17, a second pivot recess 18, and a second receiving recess 19.

**[0082]** The constructional element 1 extends longitudinally along a longitudinal axis L, and is pivotable about a pivot axis B. The pivot axis B is essentially perpendicular to the rotational axis A and tangential to the surface of the cylindrical body formed by a plurality of elements 1.

**[0083]** The centre portion 11 comprises a first surface 11a and a second opposite surface 11b. The first and second surfaces 11a, 11b are substantially flat and parallel. The first surface 11a may be referred to as a top surface of the centre portion and the second surface 11b may be referred to as a bottom surface of the centre portion 11. The centre portion 11 further comprises a third surface 11c. The third surface 11c may also be referred to as an envelope surface or cylinder surface of the centre portion 11 and is curved around the longitudinal axis L.

**[0084]** A protrusion extends essentially perpendicularly from each of the two surfaces 11a, 11b of the centre portion 11. The first protrusion 12 extends essentially perpendicularly from the first surface 11a of the centre portion 11. The second protrusion 13 extends essentially perpendicularly from the second surface 11b of the centre portion 11.

**[0085]** The first protrusion 12 comprises a first surface 12a; a second surface 12b; a third surface 12c; and a fourth surface 12d.

**[0086]** The second protrusion 13 comprises a first surface 13a; a second surface 13b; a third surface 13c; a fourth surface 13d and a fifth surface 13e.

**[0087]** Referring to Fig. 1c, the centre portion 11 further comprises a fourth surface 11d and a fifth surface 11e. The fourth and fifth surfaces 11d, 11e, are substantially flat and perpendicular to the first and second surfaces 11a, 11b of the centre portion 11. Thus, the fourth and fifth surfaces 11d, 11e are substantially parallel with the longitudinal axis L. The fourth surface 11d is arranged at the base of the second protrusion 13, aligned with the second surface 13b of the second protrusion 13. The fifth surface 11e is arranged at the base of the first protrusion 12, aligned with the second surface 12b of the first protrusion 12, as shown, e.g., in Fig. 1c.

**[0088]** The centre portion 11 further comprises a V-shaped projection 111. The V-shaped projection 111 extends from the first surface 11a to the second surface 11b of the centre portion. The V-shaped projection 111 comprises a first surface 111a and a second surface 111b. As can be seen in Fig. 1c, the first and second surfaces 111a, 111b may be convexly shaped and extend obliquely from the first surface 11a to the second surface 11b, essentially in a direction towards the second protrusion 13. Thus, the first and second surfaces 111a, 111b, of the V-shaped projection 111 are not orthogonal in relation to the first and second surfaces 11a, 11b of the centre portion. The respective shapes of the first and second surfaces 111a, 111b, of the V-shaped projection 111 may be said to be cylindrical, e.g. corresponding to the surface of a cylindrical segment with a different longitudinal axis than the constructional element 1.

**[0089]** When a second constructional element 1 is attached to a first constructional element 1 of the same type, the first surface 111a of the V-shaped projection 111 of the first constructional element provides a sliding surface for the third surface 12c of the first protrusion 12 of the second constructional element. Thus, the first surface 111a of the V-shaped projection 111 may be configured to provide a sliding surface for the first protrusion 12 of another constructional element 1. The first surface 111a of the V-shaped projection 111 may thereby be configured to slide against and engage with the third surface 12c of the first protrusion 12 of another element 1.

**[0090]** Correspondingly, when a second constructional element 1 is being attached to a first constructional element 1 of the same type, the second surface 111b of the V-shaped projection 111 of the second constructional element provides a sliding surface for the third surface 13c of the second protrusion 13 of the second constructional element. Thus, the second surface 111b of the V-shaped projection 111 may be configured to provide a sliding surface for the second protrusion 13 of another constructional element 1. The second surface 111b of the V-shaped projection 111 may thereby be configured to slide against and engage with the third surface 13c of the second protrusion 13 of another element 1.

**[0091]** Referring to Figs. 1a-c, the first receiving recess 14 is formed between the V-shaped projection 111 and the part of the centre portion 11 that forms the base for the second protrusion 13. Specifically, the first receiving recess 14 is formed between the first surface 111a of the V-shaped projection 111 and the fourth surface 11d of the centre portion 11. The first receiving recess 14 is configured to receive the first protrusion 12 of an adjacent constructional element 1.

**[0092]** Referring again to Figs. 1a-c, the second receiving recess 19 is formed between the V-shaped projection 111 and the part of the centre portion 11 that forms the base for the first protrusion 12. Specifically, the second receiving recess 19 is formed between the second surface 111b of the V-shaped projection 111 and the fifth surface 11e of the centre portion 11.

**[0093]** Referring to Fig. 1c, the first surface 12a of the first protrusion 12 may also be referred to as a top surface of the first protrusion 12 and is arranged substantially perpendicular to the longitudinal axis L. Thereby, the first surface 12a is arranged substantially parallel with the first and second surfaces 11a, 11b of the centre portion 11.

**[0094]** The second surface 12b of the first protrusion 12 may also be referred to as a side surface of the first protrusion 12 and is arranged substantially flat and perpendicular to the first surface 12a. The shape of the second surface 12b corresponds to the shape of the fourth surface 11d of the centre portion 11. The second surface 12b of a first constructional element 1 may thus rest against the fourth surface 11d of the centre portion 11 of a second constructional element 1. The second surface 12b is arranged adjacent to the fifth surface 11e of the centre portion 11.

**[0095]** The third surface 12c of the first protrusion 12 may also be referred to as a side surface of the first protrusion 12 and extends somewhat concavely between the first surface 12a of the first protrusion 12 and the top surface 11a of the centre portion 11. The third surface 12c of the first protrusion 12 may be said to be cylindrical, e.g. corresponding to the surface of a cylindrical segment with a different longitudinal axis than the constructional element 1.The shape of the third surface 12c corresponds to the first surface 111a of the V-shaped projection 111 such that the third surface 12c of a second constructional element 1 may slide against the first surface 111a of a first constructional element 1.

**[0096]** The fourth surface 12d may also be referred to as an envelope surface of the first protrusion 12 and is arranged along the outer circumference of the first protrusion 12.

**[0097]** Referring to Figs. 1a-c, the first surface 13a of the second protrusion 13 may also be referred to as a bottom surface of the second protrusion 13 and is arranged in a plane which is substantially perpendicular to the longitudinal axis L. Thereby, the first surface 13a is arranged substantially parallel with the first and second surfaces 11a, 11b of the centre portion 11.

**[0098]** The second surface 13b may be referred to as a side surface of the second protrusion 13 and is arranged substantially flat and parallel with the longitudinal axis L. The second surface 13b is arranged aligned with

the fourth surface 11d of the centre portion 11, as shown in Fig. 1c. The shape of the second surface 13b corresponds to the shape of the fifth surface 11e of the centre portion 11. The second surface 13b of a first constructional element 11 may thus rest against the fifth surface 11e of the centre portion 11 of a second constructional element 1, in an assembled state.

**[0099]** The third surface 13c may also be referred to as a side surface of the second protrusion 13 and is essentially concave. The third surface 13c of the second protrusion 13 may be said to be cylindrical, e.g. corresponding to the surface of a cylindrical segment with a different longitudinal axis than the constructional element 1.The shape of the third surface 13c of the second protrusion 13 corresponds to the second surface 111b of the V-shaped projection 111, such that the third surface 13c of a first constructional element 1 may slide against the second surface 111b of the second constructional element 12.

**[0100]** The fourth surface 13d may also be referred to as a side surface of the second protrusion 13 and extends between the first surface 13a of the second protrusion and the second, bottom, surface 11b of the centre portion 11. The fourth surface 13d is curved and, thus, inclined in relation to the longitudinal axis L. As shown in Fig. 1d, the fourth surface 13d is convex and may be said to be cylindrical, i.e. corresponding to the surface of a cylindrical segment with a different longitudinal axis than the constructional element 1. The shape of the fourth surface 13d corresponds to the third surface 12c of the first protrusion 12, such that the fourth surface 13d of the second protrusion 13 of a first constructional element 1 may receive the third surface 12c of the first protrusion 12 of a third constructional element.

**[0101]** Referring to Figs. 1c-d, the fourth surface 13d of a first constructional element 1 side-by-side with the first surface 111a of the V-shaped projection 111 of a second constructional element 1 together form a surface which corresponds to the full extent of the third surface 12c of the first protrusion 12 of a third constructional element. Thus, the first protrusion 12 of a third constructional element may be inserted into a cavity 31 (not shown) that is formed when a first and a second constructional element 1 are connected. Thereby, the first protrusion 12 of a third constructional element 1 may be inserted into the cavity 31 by sliding the third surface 12c against the fourth surface 13d of the second protrusion of the first constructional element 1 joined with the first surface 111a of the V-shaped projection 111 of the second constructional element 12. Inserting the first protrusion 12 of a third constructional element into the cavity 31 formed by two previously joined constructional elements, to form an arrangement, is described in further detail below.

**[0102]** The fifth surface 13e of the second protrusion may also be referred to as an envelope surface of the second protrusion 13 and is arranged along the outer circumference of the second protrusion 13.

**[0103]** Referring to Figs. 1a-d, the first and second pivot parts 15, 16, are configured to interact with the first and second pivot recesses 17, 18. The first and second pivot parts 15, 16 are arranged on opposite sides of the centre portion 11. The first pivot part 15 extends from the second surface 11b of the centre portion 11, and the second pivot part 16 extends from the first surface 11a of the centre portion. The pivot parts 15, 16 are substantially identical in shape. The first and second pivot recesses 17, 18, are arranged on opposite sides of the centre portion 11. The first pivot recess 17 is arranged at the first surface 11a of the centre portion 11 and the second pivot recess 18 is arranged at the second surface 11b of the centre portion 11. The pivot recesses 17, 18 are substantially identical in shape. The pivot parts 15, 16 are convex and correspond to the first and second pivot recesses 17, 18, which are concave. The respective shapes of the pivot parts and pivot recesses may be said to be cylindrical, e.g. corresponding to the surface of a cylindrical segment with a different longitudinal axis than the constructional element 1.

**[0104]** The first pivot recess 17 is adapted to receive the first pivot part 15 of another constructional element 1 such that, during assembly of a constructional arrangement, the convex surface of the first pivot part 15 of a first constructional element 1 may be inserted into and supported against the concave surface of the first pivot recess 17 of a second constructional element 1. Thereby, the first pivot recess 17 may act as both connecting means and guiding means by providing a guiding surface for connecting one constructional element 1 with another constructional element 1.

**[0105]** Correspondingly, the second pivot recess 18 of a first constructional element 1 is adapted to receive the second pivot part 16 of a second constructional element 1, during assembly of a constructional arrangement. Thereby, the second pivot recess 18 may act as both connecting means and guiding means by providing guiding surfaces for connecting a first constructional element 1 to a second constructional element 1.

**[0106]** Figures 2a-d show a constructional element 2 according to an example of the present disclosure. Figure 2e shows two connected constructional element 2 according to an example of the present disclosure. Directions, orientations and perspectives, such as top, bottom, side, rear and front, are used herein to facilitate understanding of the constructional element 2. Such terms are merely used as explanatory terms for describing the features of the constructional element 2 in relation to each other. Therefore, the use of such terms in no way restricts the configuration of the constructional element 2.

**[0107]** The constructional element 2 is configured to form part of a self-supported hollow cylindrical body when connected to other constructional elements 2. The self-supported hollow cylindrical body may also be referred to as a tube, a tube-shaped body, a tubular body, and the like.

**[0108]** The constructional element 2 is depicted in fig-

ures 2a-d, as seen from the front in Fig. 2a, from the back in Fig. 2b, from the top in Fig. 2c, and from the bottom in Fig. 2d.

**[0109]** The perspective in Fig. 2a may be expressed as showing an outer side of the constructional element 2, whereas the perspective in Fig. 2b may be expressed as showing an inner side of the constructional element 2. The term inner side is intended to mean a side that is facing inwards, towards the rotational axis A of an arrangement 200.

**[0110]** The perspective in Fig. 2c may be expressed as showing the top, or upper, surfaces of the constructional element 2, whereas the perspective in Fig. 2d may be expressed as showing the bottom, or lower, surfaces of the constructional element 2.

**[0111]** Referring to Fig. 2a-d, the constructional element 2 comprises a centre portion 21, a first protrusion 22, a second protrusion 23, a first receiving recess 24, a pivot part 25, a first pivot recess 27, a second pivot recess 28, and a second receiving recess 29.

**[0112]** The constructional element extends longitudinally along a longitudinal axis L, and is pivotable about a pivot axis B. The pivot axis B is perpendicular to the longitudinal axis L and tangential to the outer surface of the cylindrical body at the junction with the preceding element.

**[0113]** Referring to Fig. 2a, the centre portion 21 of the constructional element 2, comprises a first surface 21a and a second opposite surface 21b. The first and second surfaces 21a, 21b are substantially helix-shaped and double-curved, to enable the interlocking of constructional elements 2 into a helix, when forming a hollow cylindrical body. The first and second surfaces 21a, 21b, may be said to be parallel. The first surface 21a may be referred to as a top surface of the centre portion 21 and the second surface 21b may be referred to as a bottom surface of the centre portion 21. The centre portion 21 further comprises a third surface 21c. The third surface 21c may also be referred to as an envelope surface or cylinder surface of the centre portion 21 and is curved around the longitudinal axis L.

**[0114]** Referring again to Fig. 2a, the first protrusion 22 extends essentially perpendicularly from the centre portion 21 in a longitudinal, or upward, direction, as seen from the perspective of Fig. 2a. However, the first protrusion 22 is not parallel with the longitudinal axis L, but curves slightly around the axis B towards the envelope surface 21c of the constructional element 2. The first protrusion 22 is configured with a V-shaped inner surface in order to enable interaction with two previously connected constructional elements 2. In addition, the first protrusion 22 is configured to form part of an inner surface of the hollow cylindrical body formed by a plurality of constructional elements 2.

**[0115]** The second protrusion 23 extends perpendicularly from the centre portion 21 in a lateral, or sideways, direction. The second protrusion 23 comprises a hook portion 23a, configured to engage with the first pivot recess 27 of an adjacent constructional element 2. The hook portion 23a is somewhat curved around the axis B and the bottom surface of the hook portion 23a extends radially inwards. The shape of the hook portion 23a corresponds to the shape of the first pivot recess 27. The second protrusion 23 further comprises an envelope, or cylinder, surface, which is curved around the longitudinal axis L. The second protrusion 23 may in this example also constitute a pivot part.

**[0116]** Referring to Fig. 2b showing the inner side of the constructional element 2, the first receiving recess 24 is formed at the inner surface of the constructional element 2. The first receiving recess 24 is configured to interact with the first protrusion 22 of another constructional element 2, when connected in an arrangement such as the arrangement 200 shown in Fig. 5a.

**[0117]** As shown in Fig. 2a, the pivot part 25 extends perpendicularly to, and in a downward direction from, the first surface 21a, of the centre portion 21. In other words, the pivot part 25 extends in a direction towards the second, or bottom, surface 21b of the centre portion 21. The pivot part 25 comprises an envelope, or cylinder, surface, which is curved around the longitudinal axis L. The pivot part 25 is configured to engage with a second pivot recess 28 of another constructional element 2. The shape of the pivot part 25 thus corresponds to the shape of the second pivot recess 28. The pivot part 25 comprises a convex pivot surface, as shown in Fig. 2a, which corresponds to a concave surface of the second pivot recess 28.

**[0118]** The first pivot recess 27 is slightly L-shaped and arranged below and to the side of the pivot part 25. The second pivot recess 28 is formed between the hook portion 23a of the second protrusion 23 and the centre portion 21. The shape of the first pivot recess 27 corresponds to the shape of the hook portion 23a.

**[0119]** Referring to Fig. 2b showing the inner surface of the constructional element 2, the second receiving recess 29 is formed at the inner surface of the constructional element 2. The second receiving recess 29 is configured to interact with the first protrusion 22 of another constructional element 2. Referring now to Fig. 2e, the first receiving recess 24 and second receiving recess 29 together form a cavity 32, configured to receive the first protrusion 22 of another constructional element 2, when connected in an arrangement such as the arrangement 200 shown in Fig. 5a.

**[0120]** The envelope surfaces of the centre portion 21, the pivot part 25, and the second protrusion 23 together form part of the envelope surface of the self-supported hollow cylindrical body, when connected to other constructional elements 2 in an arrangement, such as the arrangement 200 shown in Fig. 5a. The envelope surface may also be referred to as a cylinder surface or outer surface of the hollow cylindrical body. The envelope surface may also be referred to as an outer surface of a tubular body.

**[0121]** Referring to Fig. 3, a general method for assembling a constructional arrangement 100, 200, according

to an example is presented. Detailed examples of the general method in Fig. 3 are given below, with reference to Figs. 4b and 5b. It is to be understood, however, that the method presented in Fig. 3 is by no means limited to the examples presented in Figs. 4b and 5b. Many other examples and variations of the method are possible, within the scope of the present disclosure.

**[0122]** The method shown in Fig. 3 comprises connecting s100 the constructional elements 1, 2, sequentially.

**[0123]** The method may be performed manually or automatically by means of a machine, such as an industrial robot.

**[0124]** As an example, a second constructional element 1, 2, may be connected to a first constructional element 1, 2, and thereafter, a third constructional element 1, 2, may be connected to the first and second constructional elements 1, 2. Thereafter, any desirable number of constructional elements 1, 2, may be added to the arrangement 100, 200.

**[0125]** The constructional elements 1, 2, may be assembled according to the principle of last in, first out. This means that the constructional element 1, 2, that was attached last when assembling an arrangement 100, 200, is the element that must be removed first when disassembling the arrangement 100, 200.

**[0126]** According to some embodiments of the present disclosure, the step of connecting s100 the constructional elements sequentially may comprise, for each consecutive constructional element 1, 2: arranging s101 the constructional element 1, 2, angularly displaced about the rotational axis A in relation to the other constructional elements 1, 2. Thereafter, the method may further comprise pivoting s102 the constructional element 1, 2, about a pivot axis B, perpendicular to the rotational axis A, to connect the constructional element 1, 2, to at least the previous constructional element 1, 2, in the sequence.

**[0127]** By way of example, a first constructional element 1, 2, is connected to a second constructional element 1, 2, by first displacing the two constructional elements angularly about a rotational axis A in relation to each other, for example by rotating either the first or the second constructional element 1, 2. Thereafter, the second constructional element 1, 2, may be pivoted about a pivot axis B, which is perpendicular to the rotational axis A. Due to the configuration of the constructional elements 1, 2, the two constructional elements 1, 2 are thereafter connected to each other.

**[0128]** Referring to Fig. 4a, a constructional arrangement 100 according to an example is presented. The constructional arrangement 100 may comprise at least three constructional elements as disclosed in Figures 1a-d. The constructional arrangement 100 exemplified in Fig. 4a comprises a first constructional element 101, a second constructional element 102 and a third constructional element 103. The constructional elements 101, 102, 103 of the arrangement 100 are of the same type, i.e. essentially identical or similar, and may be placed in any suitable order in the constructional arrangement 100 of Fig. 4a.

**[0129]** Each constructional element 101, 102, 103, is joined to the previous element by first displacing it angularly and then employ a pivoting movement abound the pivot axis B. The angular displacement between the elements is advantageously about 120 degrees. Due to the corresponding shapes of the surfaces of the constructional elements, the pivoting movement allows for a smooth joining of one constructional element 101, 102, 103, with the one or two previous elements 101, 102, 103. As a consequence of the form-locking effect achieved, three constructional elements 101, 102, 103, form a self-supported solid cylindrical body when joined together. Once at least three constructional elements are joined together, only the last attached element is removable. In the example shown in Fig. 4a, if the first constructional element 101 and the second constructional element 102 are connected first, and thereafter the third constructional element 103 is connected to the first and second constructional elements 101, 102, then only the third constructional element 103 may be removed from the arrangement. Once the third constructional element 103 has been removed, the first and second constructional elements 101, 102 may be disconnected from each other.

**[0130]** Referring to Fig. 4a, the first pivot part 15 of the first constructional element 101 interacts with the first pivot recess 17 of the second constructional element 102, when connected. The centre portion 11 of the first constructional element 101 interacts with the first protrusion 12 of the second constructional element 102. The cavity 31 is formed between the second protrusion 13 of the first constructional element 101 and the centre portion 11 of the second constructional element 102. The cavity 31 forms a receiving cavity where the first protrusion 12 of the third constructional element 103 may be inserted.

**[0131]** In order to join the third constructional element 103 with the first and second constructional elements 101, 102, and achieve the form-locking effect, the first protrusion 12 of the third constructional element 103 is inserted into the cavity 31, by means of the pivoting movement about the pivot axis B, described above.

**[0132]** Figure 4b schematically illustrates a method for assembling the constructional arrangement of Fig. 4a according to an example. The method will be described in relation to the arrangement 100 disclosed in Fig. 4a.The method presented in Fig. 4b constitutes a detailed example of the general method described with reference to Fig. 3, above. It is to be understood that the example of Fig. 4b is merely one of many possible variations of the method described with reference to Fig. 3.

**[0133]** The elements in an arrangement are connected sequentially, s100. For legibility and ease of understanding, it is assumed that the first surface 11a of the centre portion is always upward facing, which means the first protrusion 12 extends upward from the centre portion. In addition, arrangements are assumed to be assembled from top to bottom. This means, e.g., that a constructional

element referred to as the *third element* in a sequence is assumed to be connected to the arrangement after any constructional element referred to as the *first* or *second element* in a sequence.

**[0134]** As an example, referring to the arrangement 100 depicted in Fig. 4a, the second constructional element 102 is connected to the first constructional element 101, and thereafter, the third constructional element 103 is connected to the first and second constructional elements 101, 102. Thereafter, any desirable number of constructional elements 1 may be added to the arrangement.

**[0135]** The constructional elements are assembled according to the principle of last in, first out. This means that the constructional element that was attached last when assembling an arrangement is the element that must be removed first when disassembling the arrangement.

**[0136]** For each consecutive constructional element 1, the method of assembling a constructional arrangement comprises, arranging s101 the constructional element 1 angularly displaced about the rotational axis A in relation to the other constructional elements 1.

**[0137]** Referring to Fig. 4b, in order to join the first constructional element 101 and the second constructional element 102, either the first or the second constructional element 101, 102, needs to be rotated, i.e. displaced angularly, about the rotational axis A in relation to the other. In other words, the two elements that are to be connected must be angularly displaced in relation to each other. Advantageously, the angular displacement is about 120 degrees. Thus, the step of arranging, s101 the constructional element 1 angularly displaced about the rotational axis A in relation to the other constructional elements 1 may involve rotating the constructional element 1 in relation to the other constructional elements 1 or rotating the arrangement of connected elements 1 in relation to the consecutive constructional element 1.

**[0138]** The method further comprises pivoting s102 the constructional element 1 about a pivot axis B, perpendicular to the rotational axis A, to connect the constructional element 1 to, at least, the previous constructional element 1 in the sequence. The pivot axis B is also tangential to the envelope surface of the cylindrical body. This means that after rotating one of the at least two elements, the constructional element to be connected is pivoted and thereafter attached to the previous constructional element in the arrangement. By way of example, referring to the arrangement in Fig. 4a, when connecting the second constructional element 102 to the first constructional element 101, the second constructional element 102 is first angularly displaced (s101), in relation to the first constructional element 101, and then pivoted (s102) about a pivot axis B that is perpendicular to the rotational axis A of the constructional arrangement 100. When the second constructional element 102 has been pivoted about the pivot axis B, the longitudinal axis L of the second constructional element 102 aligns with the rotational axis L of the first constructional element 101. Thus, in an assembled state, the respective rotational axes L of the first and second constructional elements 101, 102 coincide with the rotational axis A of the arrangement, as shown in Fig. 4a.

**[0139]** According to an example of the method, the first pivot part 15 of the first constructional element 101 is inserted into the first pivot recess 17 of the second constructional element 102, in order to join the first and second constructional elements 101, 102. The pivot part 15 is inserted at an angle, such that the second constructional element 102 may be pivoted about the pivot axis B. The pivoting movement allows the pivot part 15 to be fully inserted into the first pivot recess 17 while simultaneously allowing for the joining of the first protrusion 12 of the second constructional element 102 with the receiving recess 14 of the first constructional element 101. The corresponding shapes of the first pivot part 15 and the first pivot recess 17 allow the first pivot part 15 to slide into the pivot recess 17 when pivoted around the pivot axis B at a pivot point P. Correspondingly, the corresponding shapes of the first surface 111a of the V-shaped projection 111 of the first constructional element 101 and the third surface 12c of the first protrusion 12 of the second constructional element 102, allow the third surface 12c to slide against the first surface 111a, when the second constructional element 102 is pivoted about the pivot axis B.

**[0140]** Thus, when the first and the second constructional elements 101, 102 are being joined, the first protrusion 12 of the second constructional element 102 meets the receiving recess 14 of the first constructional element 101. When the first and second constructional elements 101, 102 are connected, the first surface 111a of the V-shaped projection 111 rests against the third surface 12c of the first protrusion 12, and the fourth surface 11d of the centre portion 11 of the first constructional element 101 rests against the second surface 12b of the first protrusion 12 of the second constructional element 102.

**[0141]** When the first protrusion 12 of the second constructional element 102 is so joined with the receiving recess 14 of the first constructional element 101, the second surface 12b of the first protrusion 12 and the fourth surface 11d of the centre portion 11 are arranged substantially parallel with each other and substantially perpendicular to the first and second surfaces 11a, 11b of the centre portion 11 of the first constructional element 101.

**[0142]** Consequently, the second surface 13b of the second protrusion 13 of the first constructional element 101 rests against the fifth surface 11e of the centre portion 11 of the second constructional element 102. The second surface 13b of the second protrusion 13 of the first constructional element 101 is substantially flat and parallel with the fifth surface 11e of the centre portion 11 of the second constructional element 102, which is also substantially flat.

**[0143]** Furthermore, the second surface 11b of the centre portion 11 of the first constructional element 101 will rest, at least partly, against the first surface 11a of the centre portion 11 of the second constructional element 102. In other words, the bottom surface of the centre portion 11 of the first constructional element 101 will rest against the top surface of the centre portion 11 of the second constructional element 102.

**[0144]** Referring to the method shown in Fig. 4b, adding a third constructional element 103 to the joined first and second constructional elements 101, 102 forms a self-supported solid cylindrical body by means of the form-locking effect achieved by the configuration of the constructional elements.

**[0145]** The third constructional element 103 is connected to the first and second constructional elements 101, 102 by applying the same rotational and pivoting movements as described above. The first pivot part 15 of the second constructional element 102 is inserted into the first pivot recess 17 of the third constructional element 103. The pivot part 15 is inserted at an angle, such that the third constructional element 103 may be pivoted about the pivot axis B.

**[0146]** The pivoting movement allows the first pivot part 15 to be fully inserted into the first pivot recess 17 while simultaneously allowing for the joining of the first protrusion 12 of the third constructional element 103 with the receiving recess 14 of the second constructional element 102 as well as the second protrusion 13 of the first constructional element 101. Thus, when the third constructional element 103 is pivoted around the pivot axis B, the third surface 12c of the first protrusion 12 of the third constructional element 103 is inserted into the cavity 31 and slides against the first surface 111a of the V-shaped projection 111 of the second constructional element 102 and the fourth surface 13d of the second protrusion 13 of the first constructional element 101. The insertion of the first protrusion 12 of the third constructional element 103 into the cavity 31 completes the solid cylindrical body, thereby achieving the form-locking effect. Thus, when the third constructional element 103 is connected to the first and second constructional elements 101, 102, only the third constructional element 103 may be disconnected from the arrangement. This is consistent with the principle of first in - last out, since the third constructional element 103, which was connected last, is the constructional element that must be disconnected first, in order to disassemble the arrangement.

**[0147]** By repeating the procedure described for joining the third constructional element 103, additional constructional elements may be added to the arrangement.

**[0148]** Referring to Fig. 5a, a constructional arrangement 200 is presented, comprising a plurality of connected constructional elements 2 that interlock to form an elongated body. The constructional elements 2 may be configured as disclosed in Figures 2a-e. A constructional arrangement 200 comprising at least seven interlocking constructional elements 2 forms a self-supported hollow cylindrical body.

**[0149]** The constructional arrangement 200 according to the example shown in Fig. 5a comprises a first constructional element 201, a second constructional element 202 and a third constructional element 203, a fourth constructional element 204, a fifth constructional element 205, a sixth constructional element 206, a seventh constructional element 207, and an eight constructional element 208. The constructional elements 201-208 of the arrangement 200 are of the same type, i.e. essentially identical or similar, and may be placed in any suitable order in the arrangement 200. In the example shown in Fig. 5a, a self-supporting hollow cylindrical body is achieved when the seventh constructional element 207 is connected to the previous six interconnected elements 201-206.

**[0150]** Each consecutive constructional element 202-208 is joined to a previous element by first ensuring that the constructional element is angularly displaced about the rotational axis A in relation to the other constructional element(s). That is, either the element to be connected or the previous element(s) may be rotated about the rotational axis A. Thereafter, the element is pivoted around the pivot axis B. Due to the corresponding shapes of the surfaces, protrusions and recesses of the constructional elements 2, the pivoting movement allows for a smooth joining of one constructional element 201, 202, 203, etc., with the previous elements 201, 202, 203, etc.

**[0151]** According to the example shown in Fig. 5a, seven constructional elements 2 form a self-supported hollow cylindrical body when joined together, as a consequence of the form-locking effect achieved through the interlocking parts of the constructional elements 2. The constructional elements 201, 202, 203, 204, 205, 206, 207 are arranged side by side in a spiral/helix forming the cylindrical body. The hollow cylindrical body may also be referred to as a tube, a tubular body, a hollow rod, a hollow pole, etc.

**[0152]** Alternatively or additionally, a plurality of constructional elements 2 may be pre-connected to form a starting segment. Alternatively or additionally, a starting segment may be provided, which mimics the essential shapes of at least six interlocked constructional elements 2. By way of example, if a starting segment is provided, the constructional arrangement 200 may be assembled using the starting segment and any desirable number of constructional elements. Such a starting segment should thus reflect the essential shapes of the constructional element(s) 2 it is intended to replace, such that all subsequent constructional elements 2 may be connected to the arrangement in the manner described herein, and thereby achieve a form-lock with the starting segment.

**[0153]** The arrangement 200 of Fig. 5a will now be described more in detail with regard to the seventh constructional element 207. In the example arrangement 200, the seventh constructional element 207 is connected to the first, sixth and eight constructional elements

201, 206, 208. In addition, the centre portion 21 of the seventh constructional element 207 is arranged in contact with the second constructional element 202.

**[0154]** The seventh constructional element 207 is connected to the eighth constructional element 208 by means of the first pivot part 25 of the seventh constructional element 207, which engages the second pivot recess 28 of the eighth constructional element 208. The first pivot recess 27 of the seventh constructional element 207 is arranged to receive the second protrusion 23 of the eighth constructional element 208. When connected, the first pivot part 25 of the seventh constructional element 207 rests against the hook portion 23a of the eighth constructional element 208.

**[0155]** As shown in Fig. 5a, the hook portion 23a of the eighth constructional element 208 and the first pivot part 25 of the seventh constructional element 207 are engaged with each other in a form-fit manner. The surfaces of the first and second pivot recesses of the seventh and eighth constructional elements, respectively, may be said to provide sliding surfaces that enable two adjacent elements 2 to be pivoted into a lateral connection.

**[0156]** Similarly, the seventh constructional element 207 is connected to the sixth constructional element 206 by means of the second protrusion 23 and the second pivot recess 28 of the seventh constructional element 207, which engage the first pivot part 25 and the first pivot recess 27 of the sixth constructional element 206.

**[0157]** Furthermore, the seventh constructional element 207 is connected to the first constructional element 201 via the first protrusion 22, which engages the correspondingly shaped receiving recess 24 of the first constructional element 201. When connected, the second surface 21b of the first constructional element 201 rests, at least partly, flush against the first surface 21a of the seventh constructional element 207.

**[0158]** In order to form the arrangement shown in Fig. 5a, the seventh constructional element 207 is brought into contact with the sixth constructional element 206 at a pivot point P and pivoted about the pivot axis B. The pivoting movement connects the seventh constructional element 207 with both the first and the sixth constructional element 201, 206. To connect the eighth constructional element 208, it is brought into contact with the seventh constructional element 207, at a pivot point P, and thereafter pivoted about the pivot axis B.

**[0159]** When two constructional elements are connected laterally, the first receiving recess 24 of one of the elements forms a cavity 32 together with the second receiving recess 29 of the other element, as was shown in Fig. 2e. The cavity 32 is shaped correspondingly to the V-shape of the first protrusion 22 of each constructional element 2. Referring to the arrangement 200 shown in Fig. 5a, when the eighth constructional element 208 is connected to the arrangement 200, the first protrusion 22 of the eighth constructional element 208 engages both the first receiving recess 24 of the second constructional element 202 and the second receiving recess 29 of the first constructional element 201. In other words, the first receiving recess 24 of the eighth constructional element 208 and the second receiving recess 29 of the first constructional element 201 form the cavity 32, into which the first protrusion 22 of the eighth constructional element 208 is inserted. The first protrusion 22 of the eighth constructional element 208 is inserted into the cavity 32 by means of the pivoting movement about the pivot axis B, described above.

**[0160]** Figure 5b schematically illustrates a method for assembling a constructional arrangement according to an example. The method will be described in relation to the arrangement 200 disclosed in Figure 5a. The method presented in Fig. 4bconstitutes a detailed example of the general method described with reference to Fig. 3, above. It is to be understood that the example of Fig. 4b is merely one of many possible variations of the method of Fig. 3.

**[0161]** The constructional elements in an arrangement are connected sequentially, s100. For legibility and ease of understanding, it is assumed that the first surface 21a of the centre portion is always upward facing, which means that the first protrusion 22 extends upward from the centre portion 21. In addition, arrangements are assumed to be assembled from top to bottom. This means, e.g., that a constructional element referred to as the *third element* in a sequence is assumed to be connected to the arrangement after any constructional element referred to as the *first* or *second element* in a sequence.

**[0162]** As an example, referring to the arrangement 200 depicted in Fig. 5a, the constructional elements 201-208 are assembled in a sequence starting from the first constructional element 201. In the sequence, the second constructional element 202 is connected to the first constructional element 201, the third constructional element 203 is connected to the second constructional element 202, the fourth constructional element 204 is connected to the third constructional element 203, etc.

**[0163]** The constructional elements are assembled according to the principle of last in, first out. This means that the constructional element that was attached last when assembling an arrangement is the element that must be removed first when disassembling the arrangement.

**[0164]** For each consecutive constructional element 2, the method of assembling a constructional arrangement comprises arranging s101 the constructional element 2 angularly displaced about the rotational axis A in relation to the other constructional elements 2.

**[0165]** Referring to Fig. 5b, in order to join the first constructional element 201 and the second constructional element 202, either the first or the second constructional element 201, 202, needs to be angularly displaced in relation to the other. In general terms, the two elements that are to be connected must be angularly displaced in relation to each other. Advantageously, the angular displacement is about 57 degrees. Thus, the step of arranging s101 the constructional element 2 angularly displaced

about the rotational axis A in relation to the other constructional elements 1 may involve rotating the constructional element 2 in relation to the other constructional element(s) 2 or rotating the arrangement of connected elements 2 in relation to the consecutive constructional element 2. In other words, the step of arranging s101 the constructional element 2 angularly displaced about the rotational axis A in relation to the other constructional elements 1 may be referred to as ensuring that the constructional element 2 to be connected and the other constructional elements are angularly displaced in relation to each other.

**[0166]** Thus, either the first constructional element 201 or the second constructional element 202 is angularly displaced, e.g. by rotation, about the rotational axis A, in relation to the other. By way of example, in order to connect the first and second constructional elements 201, 202, the second constructional element 202 is rotated about the rotational axis A in relation to the first constructional element 201. Advantageously, the second constructional element 202 is rotated about 60 degrees in relation to the first constructional element 201.

**[0167]** The method further comprises pivoting s102 the constructional element 2 about a pivot axis B, perpendicular to the rotational axis A, to connect the constructional element 2 to, at least, the previous constructional element 2 in the sequence. This means that after rotating one of the at least two elements, the constructional element to be connected is pivoted and thereby attached to the previous constructional element(s) in the arrangement. For example, when connecting the second constructional element 202 to the first constructional element 201, the second constructional element 202 is first angularly displaced s101 in relation to the first constructional element 201, and then pivoted s102 about a pivot axis B that is perpendicular to the rotational axis A of the constructional arrangement 200. When the second constructional element 202 has been pivoted about the pivot axis B, the longitudinal axis L of the second constructional element 202 is parallel with the longitudinal axis L of the first constructional element 201.

**[0168]** In other words, the second constructional element 202, after having been rotated, is brought into contact with the first constructional element 201 at a pivot point P and pivoted about the pivot axis B. When the second constructional element 202 is pivoted about the axis B, the second protrusion 23 of the second constructional element 202 engages the correspondingly shaped first pivot recess 27 of the first constructional element 201. Additionally, the second pivot recess 28 of the second constructional element 202 engages the first pivot part 25 of the first constructional element 201. When the respective parts of the constructional elements have been brought into engagement, a lateral connection between the two constructional elements 201, 202 has been achieved.

**[0169]** According to an example of the method, additional constructional elements 203-206 are sequentially connected, laterally, in the same manner as described above for the first and second constructional elements 201, 202.

**[0170]** After having assembled six constructional elements 201-206, the seventh constructional element 207 may be connected to the structure. Adding the seventh constructional element 207 achieves a more stable and robust form-locking effect between the assembled constructional elements. Thus, by connecting the seventh constructional element 207 to the previous six elements, a self-supported hollow cylindrical body is obtained.

**[0171]** When brought into contact with the sixth constructional element 206 and pivoted about the pivot axis B the seventh constructional element 207 engages and interlocks the first and sixth constructional elements 201, 206. The seventh and sixth constructional elements 207, 206 connect laterally in the manner described above. The seventh and first constructional elements 207, 201 connect vertically, wherein the first constructional element 201 is arranged above the seventh constructional element 207. In other words, the seventh constructional element 207 is arranged such that the second surface 21b of the first constructional element 201 rests, at least partly, against the first surface 21a of the seventh constructional element 207. The seventh and first constructional elements 207, 201 are connected via the first protrusion 22 of the seventh constructional element 207, which engages the correspondingly shaped receiving recess 24 of the first constructional element 201.

**[0172]** By repeating the procedure described for joining the seventh constructional element 207, additional constructional elements may be added to the arrangement 200.

**[0173]** Referring to the method shown in Fig. 5b, adding an eighth constructional element 208 to the seven previously joined constructional elements not only connects the eighth element to the structure but also further interlocks the first, second and seventh constructional elements 201, 202, 207. Thus, the stability of the self-supported hollow cylindrical body is secured through enhancing the inter-locking affect. Whereas the seventh constructional element 207 interlocks with two adjacent constructional elements 2 when connected, the eighth constructional element 208, and all consecutive elements added thereafter, interlock three adjacent constructional elements 2. The eighth constructional element 208 interlocks the first constructional element 201 and the second constructional element 202 when the first protrusion 22 of the eighth constructional element 208 is inserted into the cavity 32 formed by the second receiving recess 29 of the first constructional element 201 and the first receiving recess 24 of the second constructional element 202.

**[0174]** In line with the principle of last in, first out, only the eighth constructional element, which was connected last, may be disconnected from the other elements, when the arrangement 200 shown in Fig. 5a has been assembled according to the method described herein.

## Claims

1. A multi-purpose constructional element (1, 2), configured to be connected to other constructional elements (1, 2) to form an elongated body with a rotational axis A, wherein the constructional element is a form-locking element and comprises:

   - a centre portion (11, 21);
   - at least one protrusion (12, 13, 22, 23) extending from the centre portion (11, 21); and
   - at least one recess (14, 24, 27),

   wherein the at least one protrusion (12, 13, 22, 23) is configured to interact with the at least one recess (14, 24, 27) of another constructional element (1, 2), wherein the constructional element (1, 2) is configured so that, when connected to other constructional elements (1, 2), only the last connected constructional element (1, 2) can be disconnected from the others.

2. The constructional element (1, 2) according to claim 1, wherein the constructional element (1, 2) is configured to be connected to another constructional element (1, 2) by pivoting the constructional element (1, 2) about a pivot axis B arranged at an angle to the rotational axis A.

3. The constructional element (1, 2) according to claim 1 or 2, wherein the constructional element (1, 2) is configured such that the constructional element (1, 2), when connected to other constructional elements (1, 2), interlocks at least two previously connected constructional elements (1, 2).

4. The constructional element (1, 2) according to any one of the preceding claims,
   wherein the constructional element (1, 2) comprises a first protrusion (12, 22) and a second protrusion (13, 23), extending from the centre portion (11, 21) in a first direction respectively a second direction, wherein the first protrusion (12, 22) is configured to interact with one adjacent constructional element (1, 2) and the second protrusion (13, 23) is configured to interact with another adjacent constructional element (1, 2).

5. The constructional element (1, 2) according to any one of the preceding claims, where the constructional element (1, 2) is configured such that two adjacent connected elements (1, 2) together form a cavity (31, 32) configured to receive a protrusion (12, 22) of another adjacent element (1, 2).

6. The constructional element (1) according to any one of the preceding claims wherein the constructional element (1) is configured to be connected to at least two other constructional elements (1) to form a self-supported solid cylindrical body.

7. The constructional element (1) according to claim 6, further comprising:

   - two pivot parts (15, 16) extending from the centre portion (11) in opposite directions; and
   - two pivot recesses (17, 18) arranged on opposite sides of the centre portion (11),

   wherein the pivot recesses (17, 18) are each configured to engage with a pivot part (15, 16) of different adjacent constructional elements (1).

8. The constructional element (1) according to claim 6 or 7, wherein the centre portion (11) comprises a receiving recess (14) configured to receive a first protrusion (12) of an adjacent constructional element (1) such that a first surface (11a) of the centre portion (11) of the constructional element (1) is in level with a top surface (12a) of the first protrusion (12) of the adjacent constructional element (1).

9. The constructional element (2) according to any one of claims 1-5, wherein the constructional element (2) is configured to form part of a self-supported hollow cylindrical body.

10. The constructional element (2) according to claim 9, comprising a first protrusion (22) configured to interact with two previously connected constructional elements (2), wherein the first protrusion (22) is configured to form part of an inner surface of the hollow cylindrical body formed by the constructional elements (2).

11. The constructional element (2) according to claim 9 or 10, comprising a second protrusion (23) with a hook portion (23a), configured to engage with the at least one recess (27) of an adjacent constructional element (2).

12. A constructional arrangement (100, 200), comprising a plurality of connected constructional elements (1, 2) according to any one of claims 1- 11, wherein the constructional elements (1, 2) interlock to form an elongated body.

13. Method for assembling an arrangement (100, 200) according to claim 12, wherein the method comprises:

   - connecting (s100) the constructional elements (1, 2) sequentially.

14. Method according to claim 13, wherein the step of connecting (s100) the constructional elements (1, 2)

sequentially comprises, for each consecutive constructional element (1, 2):

- arranging (s101) the constructional element (1, 2) angularly displaced about the rotational axis A in relation to the other constructional element(s) (1, 2); and
- pivoting (s102) the constructional element (1, 2) about a pivot axis B, perpendicular to the rotational axis A, to connect the constructional element (1, 2) to at least the previous constructional element (1, 2) in the sequence.

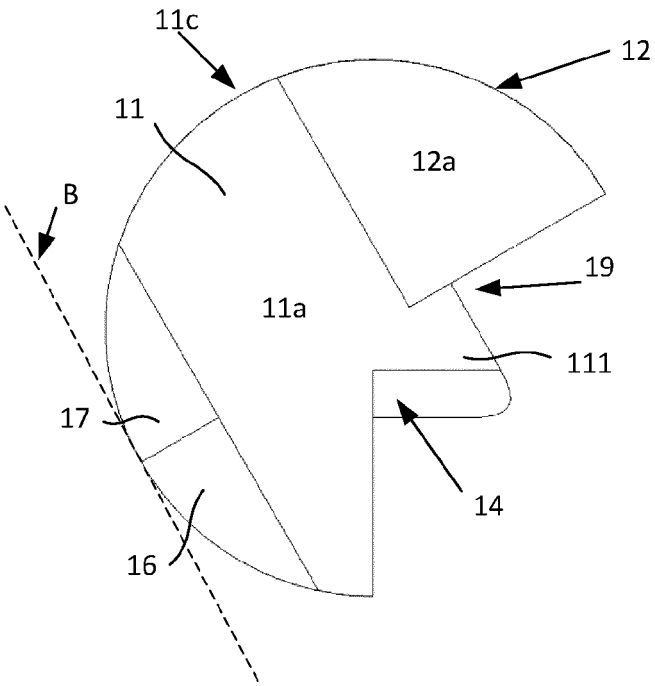


Fig. 1a

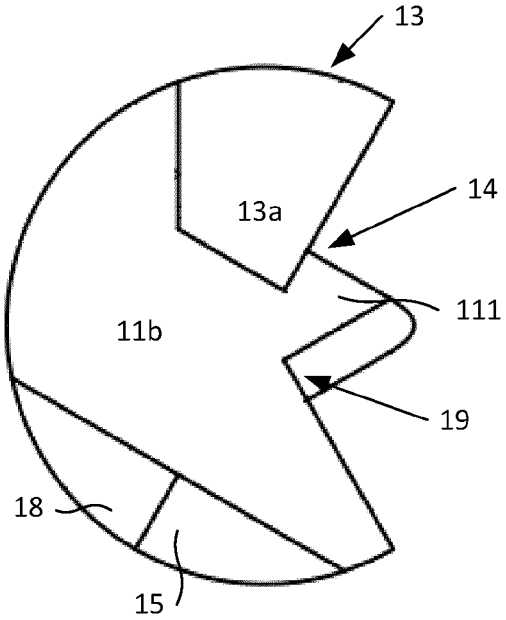


Fig. 1b

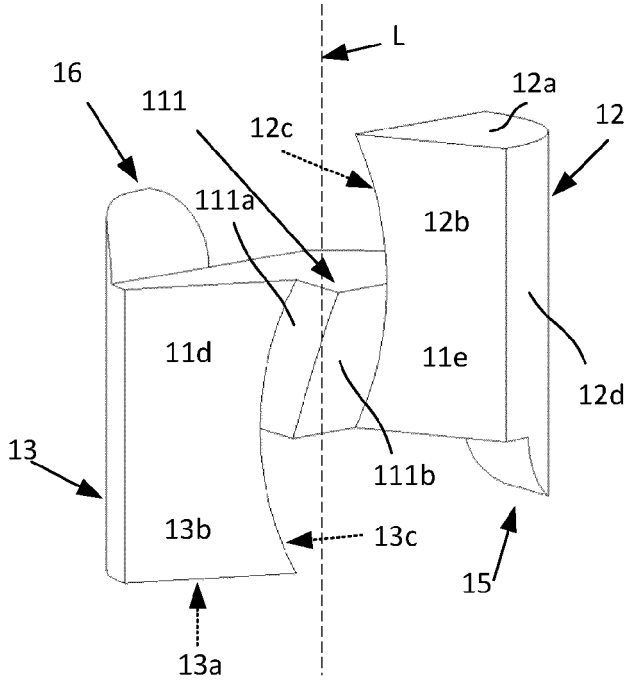


Fig. 1c

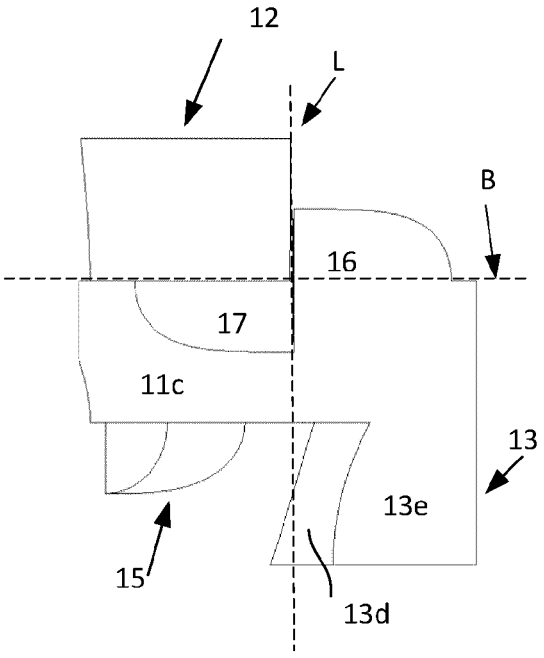


Fig. 1d

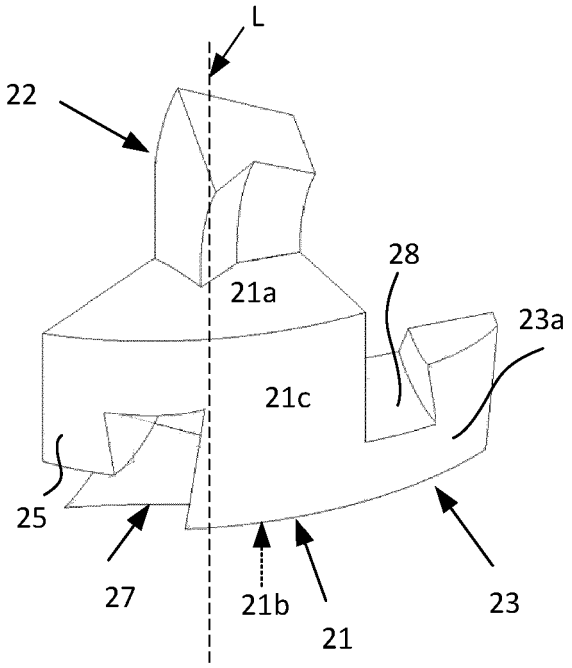


Fig. 2a

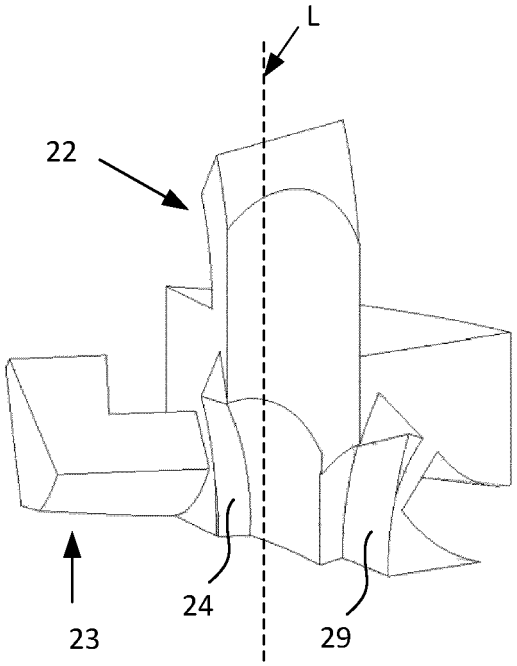


Fig. 2b

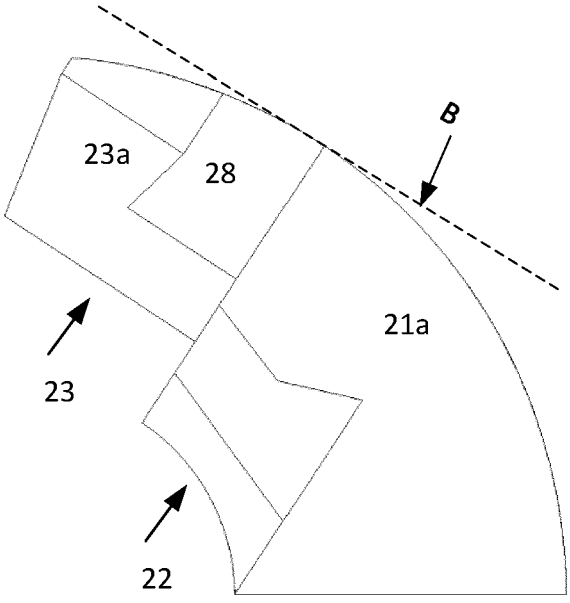


Fig. 2c

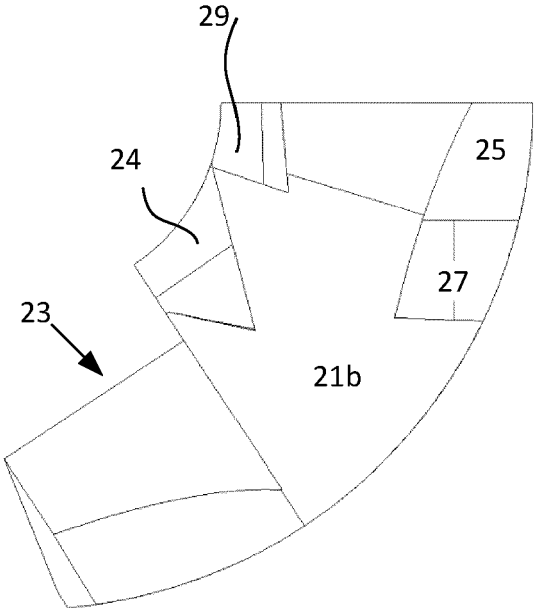


Fig. 2d

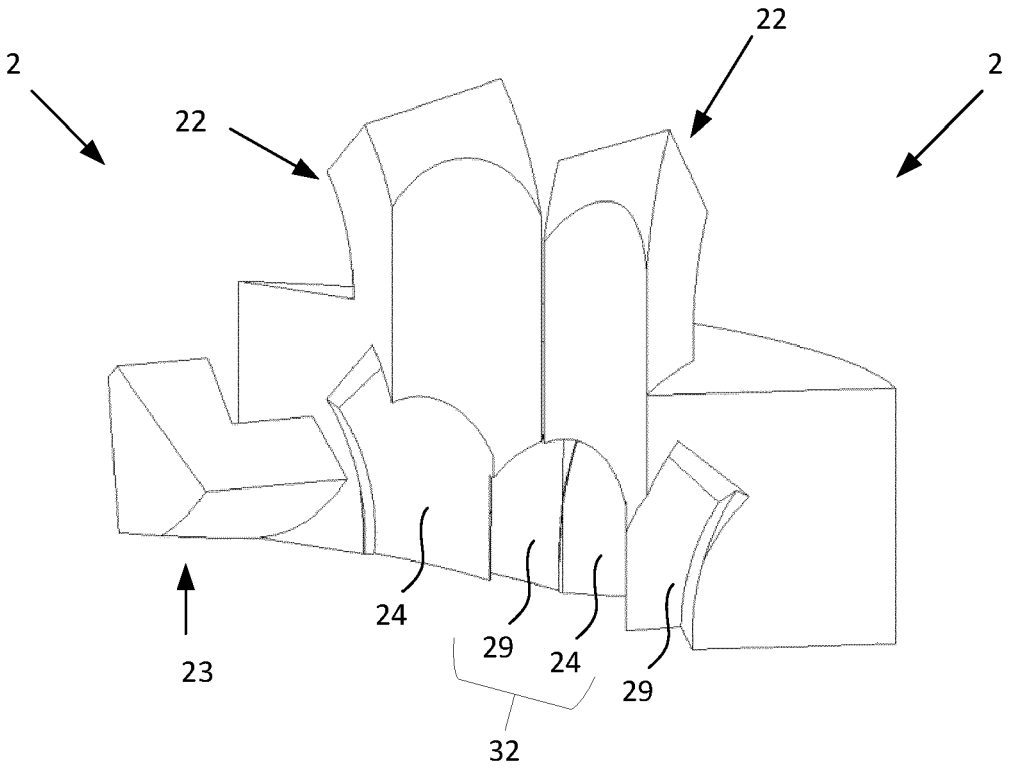


Fig. 2e

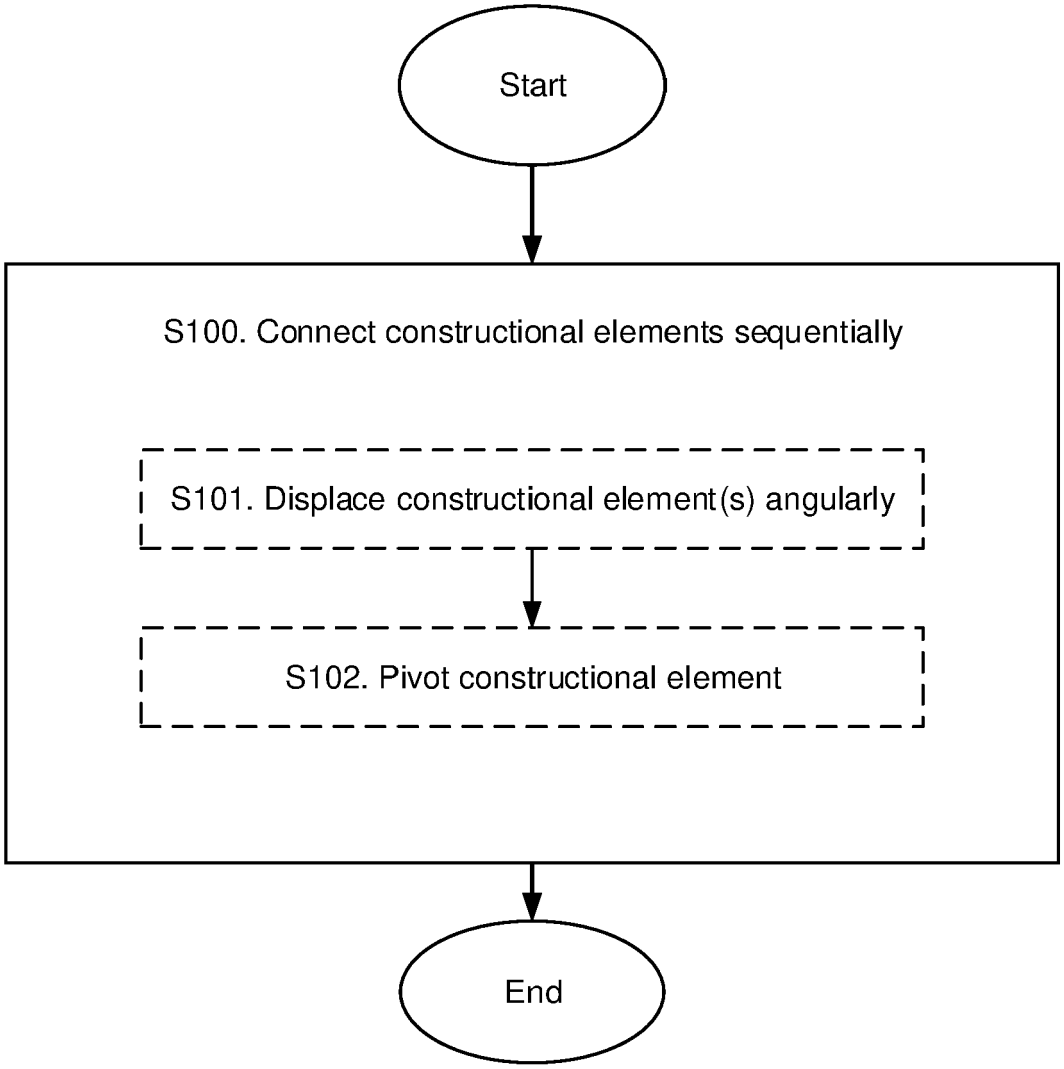
Start
S100. Connect constructional elements sequentially
S101. Displace constructional element(s) angularly
S102. Pivot constructional element
End

Fig. 3

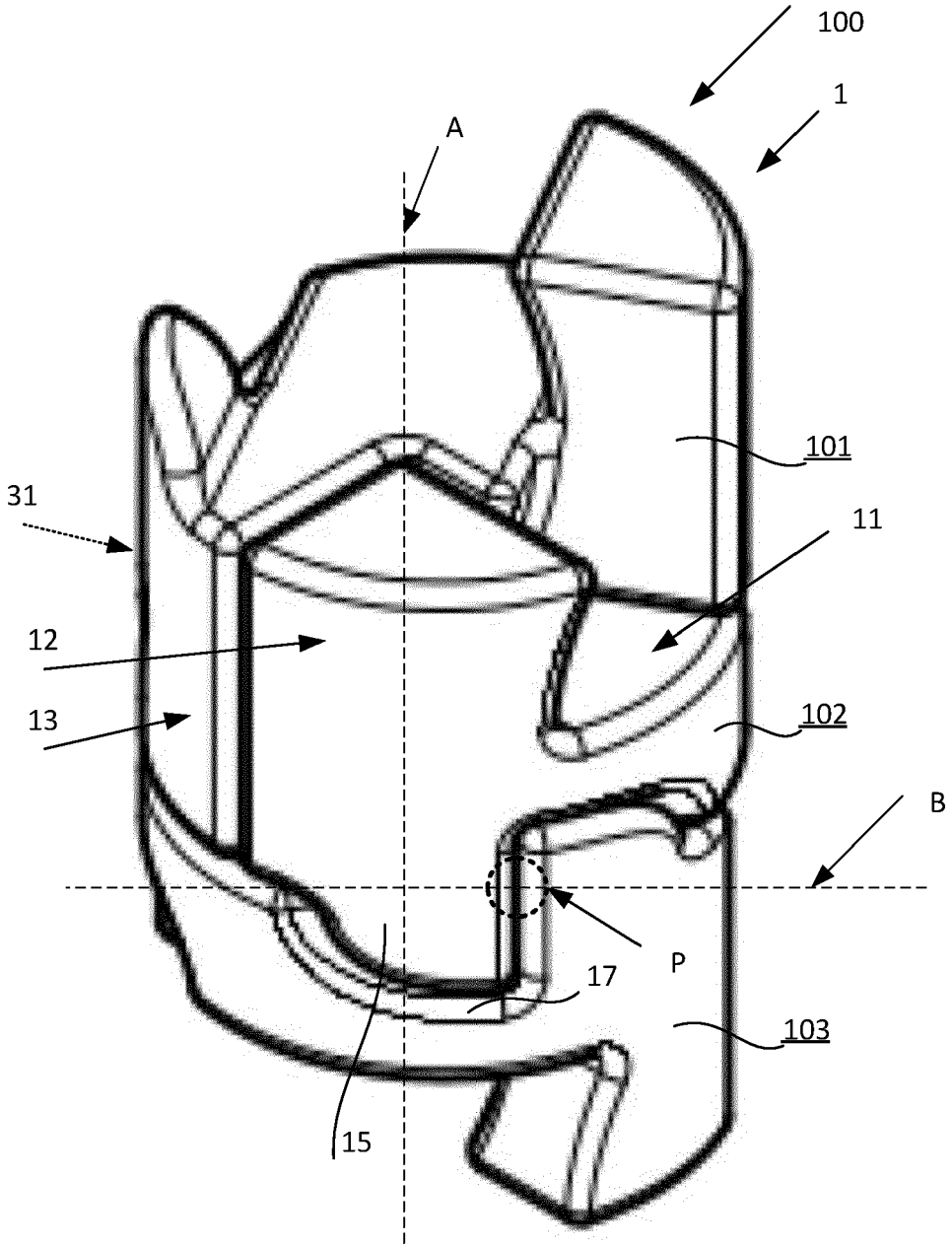


Fig. 4a

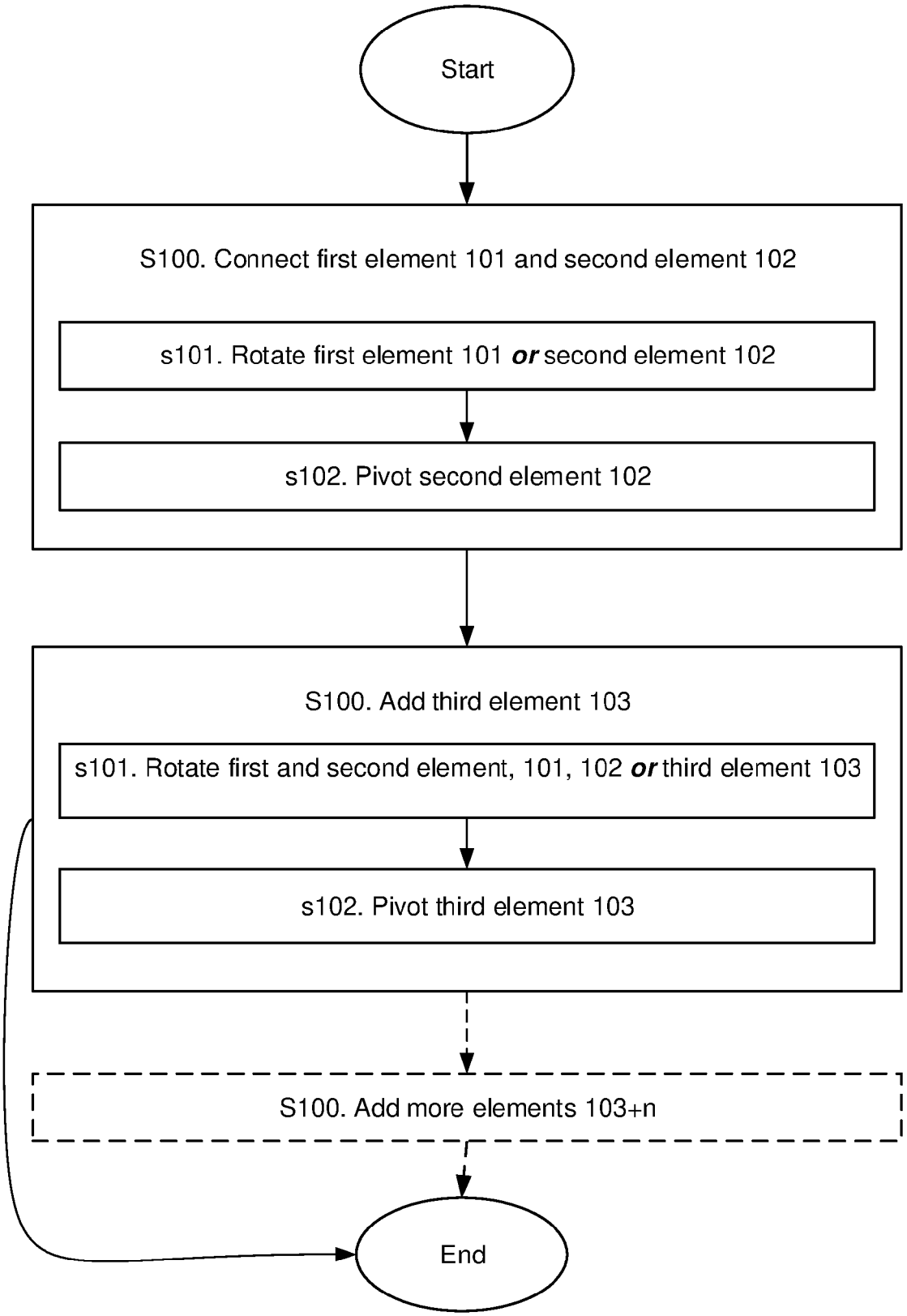
Start
S100. Connect first element 101 and second element 102
s101. Rotate first element 101 or second element 102
s102. Pivot second element 102
S100. Add third element 103
s101. Rotate first and second element, 101, 102 or third element 103
s102. Pivot third element 103
S100. Add more elements 103+n
End

Fig. 4b

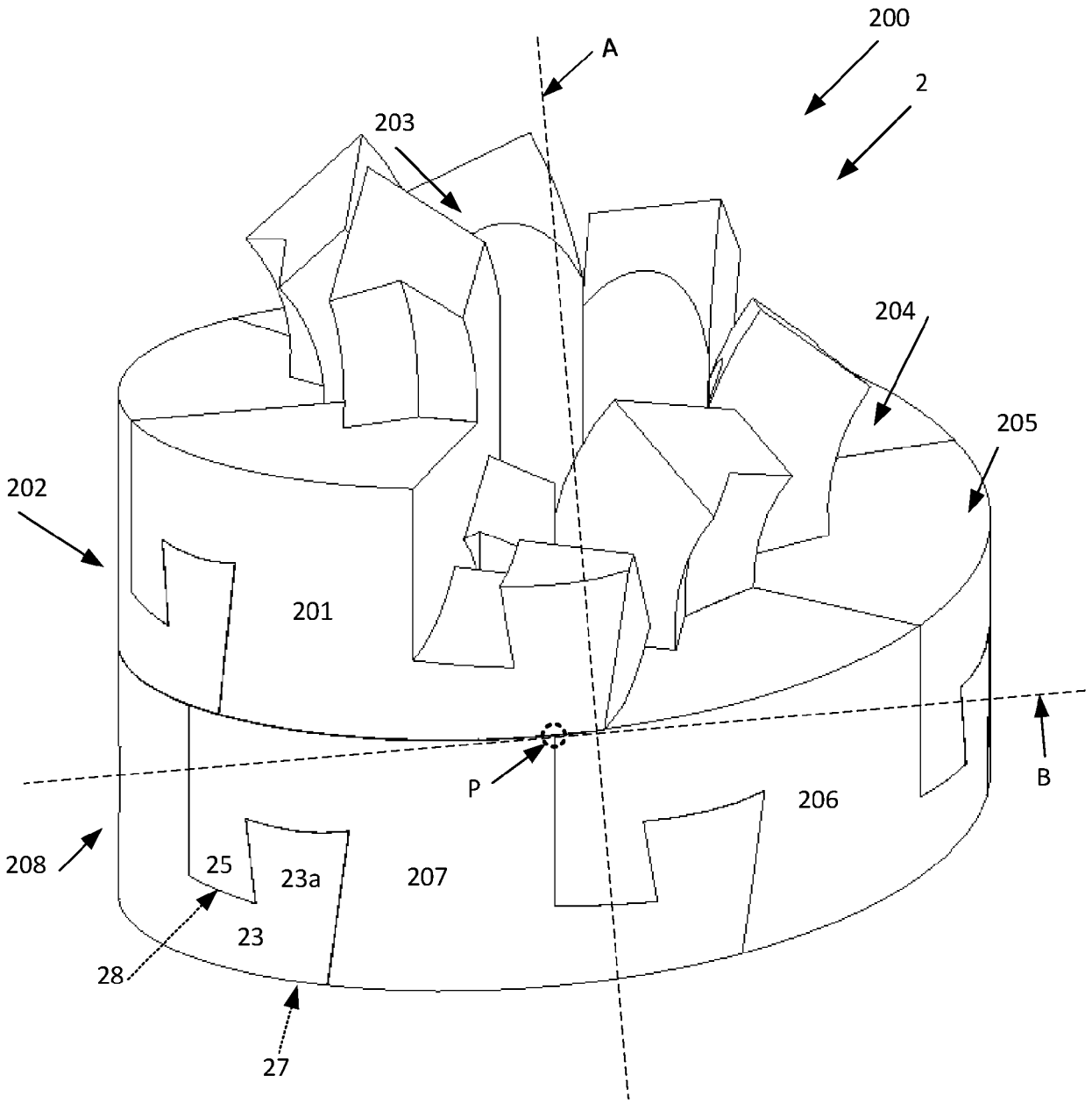


Fig. 5a

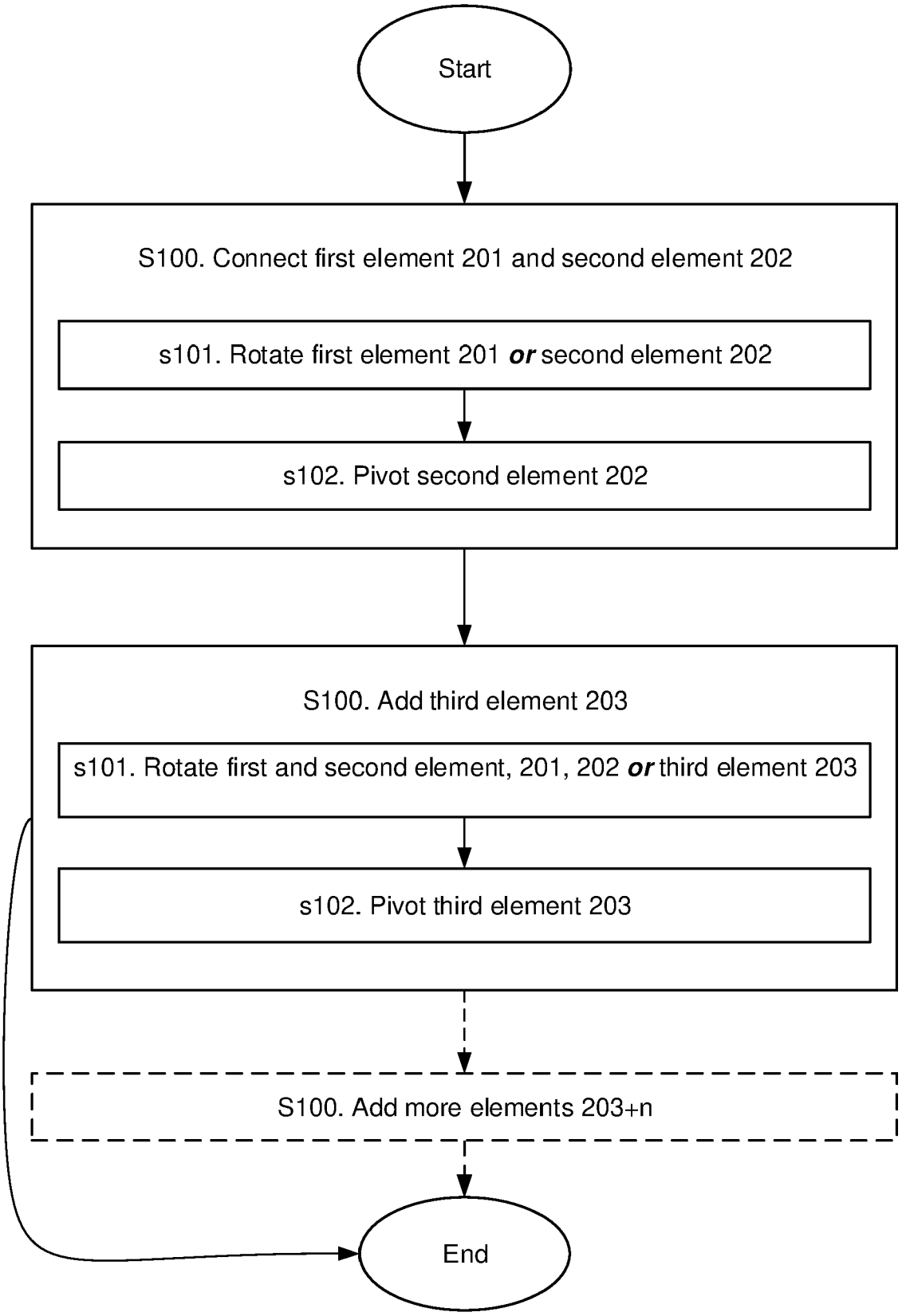
Start
S100. Connect first element 201 and second element 202
s101. Rotate first element 201 or second element 202
s102. Pivot second element 202
S100. Add third element 203
s101. Rotate first and second element, 201, 202 or third element 203
s102. Pivot third element 203
S100. Add more elements 203+n
End

Fig. 5b

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# EUROPEAN SEARCH REPORT

Application Number
EP 22 19 9386

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X | WO 2019/236999 A1 (DARTMOUTH COLLEGE [US]) 12 December 2019 (2019-12-12) * paragraph [0030] - paragraph [0071]; figures * | 1-14 | INV. A63H33/06 |
| A | WO 2018/015902 A1 (CHAN TANG [CN]; WONG YEUNG [CN]) 25 January 2018 (2018-01-25) * paragraph [0023] - paragraph [0098]; figures * | 1-14 | |
| A | US 5 853 314 A (BORA SUNIL K [US]) 29 December 1998 (1998-12-29) * column 3, line 32 - column 6, line 36; figures * | 1-14 | |
| A | US 2 800 743 A (LEONARD MEEHAN CLARENCE ET AL) 30 July 1957 (1957-07-30) * column 2, line 3 - column 4, line 22; figures * | 1-14 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC) |
| | | | A63H |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 24 January 2023 | Lucas, Peter |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 19 9386

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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24-01-2023

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| WO 2019236999 A1 | 12-12-2019 | US 2021238846 A1 | 05-08-2021 |
| | | WO 2019236999 A1 | 12-12-2019 |
| WO 2018015902 A1 | 25-01-2018 | CN 109414625 A | 01-03-2019 |
| | | WO 2018015902 A1 | 25-01-2018 |
| US 5853314 A | 29-12-1998 | US 5853314 A | 29-12-1998 |
| | | WO 9835735 A1 | 20-08-1998 |
| US 2800743 A | 30-07-1957 | NONE | |

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82