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(54) **Self-gripping device**

Selbstgreifende Vorrichtung

Dispositif auto-agrippant

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(56) References cited:
**WO-A1-2010/050831**
**US-A- 3 597 874**
**US-A1- 2007 111 634**

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## Description

**[0001]** The subject of the invention is a self-gripping device comprising self-gripping elements which move in relation to each other or to the axis running through the device on one or multiple planes.

**[0002]** Owing to their structure and shape, the devices manufactured so far impose the manner in which combination arising from connections between them are created according to strictly pre-imposed rules which do not allow any deviation from them as they are limited by the connection possibilities.

**[0003]** The currently used elements connecting the devices are permanently joined with the device and are its integral part. They take on the form of protruding elements, openings, hooks, loops and surfaces fitting into each other. They are positioned in relation to each other in a certain way which corresponds to the manner and principle of connecting where any deviation results in a lack of connection or a forced connection forming tensions. Such tensions may lead to the disconnection of the devices.

**[0004]** Document WO-A1-2010/050831 features a three-dimensional self-gripping device comprising at least three interconnected elements placed in a common base wherein the element has a head and a stem, where the stem's diameter is smaller than the head's diameter, and/or the stem's circumference is smaller than the head's circumference. The head of the self-gripping device is a three-dimensional solid figure, preferably being close to a semi-sphere or a complex three-dimensional solid in shape. The stem of the self-gripping device has the shape of a three-dimensional solid, preferably a cylinder whose circumference on the x-z plane, which is perpendicular to the straight line axis running through the head, the stem and the base of the device, is smaller than the head's circumference on the x-z plane, and/or its diameter on the x-z plane, which is perpendicular to the axis running through the head, the stem and the base of the device, is smaller than the head's diameter on the x-z plane. The base of the self-gripping device has a diameter and/or circumference which is smaller than, equal to or greater than the stem's diameter and/or circumference and takes the shape of a three dimensional form. The proportion of the stem's length to its diameter is equal or almost equal to, greater or smaller than zero. The axes of the device's stems connected to the base join or do not join at the same point on the base. The stem's axis running towards the base is a curved, straight or broken line. The head and/or the stem of the self-gripping device and/or the base are solids and/or openwork and/or blind openwork. The head, the stem and the base are made of materials of different physical properties and at least one of them is resilient and/or elastic. At least one connection between the head, the stem and the base of the self-gripping device is elastic and/or resilient. The three-dimensional gripping device connects with other three-dimensional self-gripping devices by means of the heads and the stems through clamping and/or hooking the heads with other heads and/or the heads with the stems and/or the stems with other stems.

**[0005]** The objective of the invention is to design an inexpensive and simply-constructed three-dimensional self-gripping device which, thanks to its construction, enables the easy gripping of objects and the creation of spatial forms of irregular shapes through the connection of numerous identical devices or their varieties. The self-gripping devices may be used as toy blocks or constructional elements intended for creating complex spatial forms which can be used as an element forming the structures of road surfaces, artificial ski slopes or the device and the connector can be used in reinforcing wires for creating reinforced concrete structures.

**[0006]** The aforementioned objective is achieved by a self-gripping device according to claim 1.

**[0007]** The gripping elements (**a**) have their heads (**g**) arranged such that the sum of diameters of three neighbouring heads (**g**) is larger than the sum of the distances between them and the length of the stem (**e**) is larger than the diameter and/or the height of the head (**g**) and the minimum distance between the heads (**b**) is not smaller than the diameter of the stem (**b**). The connection between the devices is effected when the heads (**g**) of the gripping elements (**a**) are hooked to each other and/or the heads (**g**) are hooked to the stems (**e**) in the event when the sum of diameters of three neighbouring heads (**g**) is smaller than the sum of the distances between them and the length of the stem (**e**) is larger than the diameter of the head (**g**). The connector (**L**) and the module (**m**) and the gripping elements (**a**) are made of materials of different or identical physical properties, preferably of resilient, elastic and low friction coefficient materials and/or non-resilient materials. The heads (**g**) of the griping elements (**a**) have smooth and/or ridged surfaces so that they can become connected with other heads [**a(1)**] of the device (**x**) of the same type. The heads (**g**) of the gripping elements (**a**) have smooth surfaces and/or surfaces with the parallel cut grooves (**t**) lying in the cut-groove (**t**) width distance from each other. The connector (**L**) is a three-dimensional solid figure, preferably with a shape being close to a solid of revolution or polygon, and that it connects the modules (**m**) in a way enabling them to revolve in relation to each other.

**[0008]** The main features of the self-gripping device are its spherical or cylindrical shape as well as the changeable position of gripping elements of the neighbouring modules of the device in relation to each other. Due to the changeable position of the gripping elements in relation to each other, the self-gripping device gains a greater ability of fitting into the gripping elements belonging to other devices of this type. Thanks to that, a situation in which some gripping elements repel each other instead of becoming fastened to them is definitely far less likely.

**[0009]** The subject of the invention was presented in the example showed in a pictorial drawing, where in Fig. 1 it is in an axonometric projection as the gripping device

**x** in a spherical form and the plane **z** perpendicular to the axis of revolution **d** around which the modules **m** revolve, in Fig. 2 a section of the device **x** in a spherical form is presented wherein two modules **m** are interconnected without a separate connector **L**, wherein the modules **m** both serve as the connectors **L** and connect to each other inseparably in a way which allows the revolution of the modules in relation to each other and in relation to the common axis **d**; in Fig. 3 a section of the device **x** in a spherical form is presented with two interconnected modules **m** with the use of two modules **m** whose bases **p** also serve as the connectors **L**, wherein all the modules revolve around the common axis **d**, in Fig. 4 the device is presented in an axonometric projection wherein it is in the form of a cylinder consisting of a few modules revolving around the common axis **d** on the plane **z**, where the common plane **z**, in which each module **m** revolves around the common axis **d** going through the centre of the base **p** of all modules **m,** is presented, in Fig. 5, 6 and 7 - the elements **m** and **a** and **L** of which the gripping device in a cylindrical form is made are presented in an axonometric projection, in Fig. 5 - two modules **m** consisting of the gripping elements **a** and the base **p** are show in an axonometric projection, in Fig. 6 - the module **m** consisting of the gripping element **a** and the base **p** integrated with the connector **L** as well as the separate connector **L** are presented in an axonometric projection, in Fig. 7 and 12 the gripping element **a** is presented in an axonometric projection, in Fig. 8 a section of the device is presented wherein it is in the form of a cylinder with the connector **L** and six modules **m** revolving around the common axis **d** on the common plane **z**, in which each module **m** revolves around the common axis **d** going through the centres of the base **p** of all modules **m,** in Fig. 9 and 13 - the device **x** in a spherical form is presented in an axonometric projection with the multiple planes **z** and multiple modules revolving around their own axes **d** connected with the connector **L**, in Fig. 10 and 11 and 12 the elements **m** and **a** and **L** are presented an axonometric projection of which the device **x** in a spherical form with numerous axes **d** is built, in Fig. 10 - the connector **L** is presented which connects the modules **m** of the device **x** in a spherical form and the multiple planes **d**, in Fig. 11 the module **m** is presented consisting of the base **p** and the gripping elements **a**, in Fig. 14 a section of the device **x** in a spherical form is presented with the numerous axes of revolution **d** with the modules **m** interconnected by means of the connector **L**, in Fig. 15 - a section of the device **x** is showed together with the options for connecting with other devices of this type from every side, in Fig. 16 - the interconnected devices **x** are presented, in Fig. 17 the same device **x** in an axonometric projection is presented as well as the changeable space **k** between the heads **g** changing their positions in relation to each other during the revolutions of the modules in relation to each other around the axis **d** on the plane **z**, where axis **d** is the axis of revolution for all modules **m** and the connector **L** or for one module **m** and the connector **L** connected with other modules **m**, in Fig. 18 the gripping element **a** and **a1** consisting of the head **g** and the stem **e** and the base **p** is presented, where the head **g** is a part of the gripping element **a** in the form of a three-dimensional solid figure preferably in a spherical or semi-spherical shape and it is connected with the stem **e** creating a solid figure, whose head **g** possesses a larger diameter than the diameter of the stem **e,** which is a part of the gripping element **a** in the form of a three-dimensional solid figure being close to a cylinder in shape, and in Fig. 19 - the gripping element **a** is presented wherein the head **g** has the diameter **sg** larger than the diameter **st** of the stem **e**.

**[0010]** As presented in figures (Fig. 1 to 19) the self-gripping device **x** is in the shape of a cylinder or a sphere and consists of the modules **m** having the gripping elements **a** as well as the axis of revolution **d** of the module **m** or of the connector **L** of modules **m,** the plane **z** perpendicular to the axis of revolution **d** around which the module revolves, the module's base **p**, the head **g** of the gripping element **a**, the base **f** of the gripping element **a**, the stem **f** of the gripping element **a,** the changeable space **k** between the heads **g**, changing their position in relation to each other during the revolutions of the neighbouring modules **m** in relation to each other around the axis **d** on the plane **z**.

**[0011]** According to the invention, the gripping device **x** consists of at least two modules **m** interconnected directly or via the separate connector **L** and of the gripping elements **a** fastened with the base **f** to the base **p** of the module **m**. The module **m** has at least one gripping element **a** and the base **p**. The base **p** of the module **m** has the shape of a three-dimensional solid, preferably a solid of revolution. The module **m** has its own axis of revolution **d** around which it revolves. The modules **m** are interconnected by means of the connector **L**. The base **p** of the module **m** serves as the connector **L** in some cases. The modules **m** revolve in relation to each other and/or the connector **L**.

**[0012]** The connector **L** connects the modules **m** enabling them to revolve in relation to each other. The connector **L** is a three-dimensional solid with a shape preferably being close to a solid of revolution. The connector **L** and the module **m** and the gripping elements **a** are made of materials of different or identical physical properties, preferably of resilient, elastic and low friction coefficient materials.

**[0013]** The gripping elements **a** are spread radially from the base **p** of the module **m** and/or its axis **d** and are fastened to the module **m**. The gripping elements **a** consist of the stem **e** of an elongated shape, preferably being close to a cylinder, and of the head **g** with a shape of a complex solid figure, preferably of a spherical shape or being mushroom-shaped.

**[0014]** The stem **e** is fastened by means of the base **f** to the module's base **p**. The stem **e** may be of any length, preferably being approximately three times larger than the height of the head **g**.

**[0015]** The head **g** has the abilities of connecting with other heads belonging to other devices through hooking or clamping (Fig. 18/a1). The diameter **sg** of the head **g** is larger than the diameter **st** of the stem **e**.

**[0016]** The space **k** between the neighbouring heads **g** of the neighbouring modules **m** is changeable because of the revolutions of these modules in relation to each other and their common or own axis **d**.

## Claims

1. A self-gripping device comprising at least two modules (m) having a base (p) having a contour of spherical or cylindrical shape and equipped with at least one embedded gripping element (a), said gripping elements (a) comprising a stem (e) in the form of a three-dimensional solid figure, preferably being close to a cylinder in shape, and a head (g) in the form of a three-dimensional solid figure, preferably being close to a sphere or a semi-sphere in shape, wherein the diameter (sg) of the head (g) is larger than the diameter (st) of the stem (e) and wherein the gripping elements spread radially from the centre of the base of the module and are connected through their base to the base of the module, **characterised in that**
   the self-gripping device further comprises a connector (L) for connecting the at least two modules (m), wherein each module (m), when connected to the connector (L), revolves around its own or common axis (d) on its own plane or in common planes (z), such that the space (k) between the neighbouring heads (**g**) of the neighbouring modules (**m**) is changeable.

2. The self-gripping device of claim 1, **characterised in that** the gripping elements (**a**) have their heads (**g**) arranged such that the sum of diameters of three neighbouring heads **(g)** is larger than the sum of the distances between them and the length of the stem (**e**) is larger than the diameter and/or the height of the head **(g)** and the minimum distance between the heads **(g)** is not smaller than the diameter of the stem (**e**).

3. The gripping device of claim 1 or 2, **characterised in that** the connection between the devices is effected when the heads **(g)** of the gripping elements **(a)** are hooked to each other and/or the heads **(g)** are hooked to the stems **(e)** in the event when the sum of diameters of three neighbouring heads **(g)** is smaller than the sum of the distances between them and the length of the stem **(e)** is larger than the diameter of the head **(g).**

4. The self-gripping device of claim 1 or 2 or 3, **characterised in that** the connector **(L)** and the module **(m)** and the gripping elements (**a**) are made of materials of different or identical physical properties, preferably of resilient, elastic and low friction co-efficient materials and/or non-resilient materials.

5. The self-gripping device of claim 1 or 2 or 3 or 4, characteristised in that the heads **(g)** of the griping elements **(a)** have smooth and/or ridged surfaces so that they can become connected with other heads **[a(1)]** of the device (**x**) of the same type.

6. The self-gripping device of claim 1 or 2 or 3 or 4 or 5, **characterised in that** the heads **(g)** of the gripping elements **(a)** have smooth surfaces and/or surfaces with parallel cut grooves (**t**) lying in the cut-groove width distance from each other.

7. The self-gripping device of claim 1, **characterised in that** the connector **(L)** is a three-dimensional solid figure, preferably with a shape being close to a solid of revolution or polygon, and that it connects the modules **(m)** in a way enabling them to revolve in relation to each other.

## Patentansprüche

1. Eine selbstgreifende Vorrichtung, die aus wenigstens zwei Modulen (**m**) besteht, die (**p**) einen kugelförmig oder zylindrisch ausgebildeten Basiskörper haben und wenigstens mit einem eingebauten Greifelement (**a**) ausgestattet sind, wo die betroffenen Greifelemente (**a**) aus einem Schaft (**e**) in Form eines dreidimensionalen Körpers, der von der Form her vorteilhaft einem Zylinder ähnlich ist, und einem Kopf (**g**) in Form eines dreidimensionalen Körpers, der von der Form her vorteilhaft einer Kugel oder Halbkugel ähnlich ist, wobei der Durchmesser (**sg**) des Kopfes (**g**) größer als der Durchmesser (**st**) des Schaftes (**e**) ist und die Greifelemente von der Mitte des Basiskörpers eines Moduls strahlenförmig auseinander gehen und durch ihren Basiskörper mit dem Basiskörper anderer Module verbunden sind, **dadurch gekennzeichnet, dass** die selbstgreifende Vorrichtung zusätzlich aus einem Verbindungsstück (**L**) zur Verbindung von mindestens zwei Modulen (**m**) besteht, wobei jeder Modul (**m**), wenn er mit dem Verbindungsstück (**L**) verbunden ist, sich um die eigene und gemeinsame Achse (**d**) in der eigenen Ebene oder in den gemeinsamen Ebenen (**z**) so dreht, dass der Raum (**k**) zwischen den benachbarten Köpfen (**g**) der benachbarten Module (**m**) veränderbar ist.

2. Eine selbstgreifende Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Greifelemente (**a**) Köpfe (**g**) haben, die so angeordnet sind, dass die Summe der Durchmesser von drei miteinander

benachbarten Köpfen (**g**) größer als die Summe der Abstände zwischen ihnen ist und die Länge des Schaftes (**e**) größer als der Durchmesser und/oder die Höhe des Kopfes (**g**) ist und der minimale Abstand zwischen den Köpfen (**g**) nicht kleiner als der Durchmesser des Schaftes (**e**) ist.

**3.** Eine selbstgreifende Vorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Verbindung zwischen den Vorrichtungen realisiert wird, wenn die Köpfe (**g**) der Greifelemente (**a**) ineinander greifen und/oder die Köpfe (**g**) und die Schäfte (**e**) eingreifen, wenn die Summe der Durchmesser von drei benachbarten Köpfen (**g**) kleiner als die Summe der Abstände zwischen ihnen ist und die Länge des Schaftes (**e**) größer als der Durchmesser des Kopfes (**g**) ist.

**4.** Eine selbstgreifende Vorrichtung nach Anspruch 1 oder 2 oder 3, **dadurch gekennzeichnet, dass** das Verbindungsstück (**L**) und der Modul (**m**) sowie die Greifelemente (**a**) aus Materialien von verschiedenen oder identischen physikalischen Eigenschaften, vorteilhaft aus elastischen, flexiblen Materialien mit niedrigem Reibungskoeffizienten und/oder aus nicht elastischen Materialien gemacht sind.

**5.** Eine selbstgreifende Vorrichtung nach Anspruch 1 oder 2 oder 3 oder 4, **dadurch gekennzeichnet, dass** die Köpfe (**g**) der Greifelemente (**a**) glatte und/oder geriffelte Oberflächen haben, so dass sie sich mit anderen Köpfen [**a(1)**] der Vorrichtung (**x**) mit derselben Bauweise verbinden können.

**6.** Eine selbstgreifende Vorrichtung nach Anspruch 1 oder 2 oder 3 oder 4 oder 5, **dadurch gekennzeichnet, dass** die Köpfe (g) der Greifelemente (**a**) glatte Oberflächen und/oder Oberflächen mit parallel eingeschnittenen Rillen (**t**) haben, die voneinander im Abstand der eingeschnittenen Rillenbreite liegen.

**7.** Eine selbstgreifende Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** das Verbindungsstück (**L**) ein dreidimensionaler Körper ist, der von der Form her vorteilhaft einem Rotationskörper oder einem Vieleck ähnlich ist, und die Module (**m**) in solcher Weise verbindet, die ihnen ermöglicht, sich umeinander zu drehen.

**Revendications**

**1.** Le dispositif auto-adhésif composé d'au moins deux modules (**m**) dont la base (**p**) a une forme sphérique ou cylindrique et dotés d'au moins un élément d'accrochage intégré (**a**), desdits éléments d'accrochage **(a)** composés d'une tige (**e**) de forme de solide trois dimensions avantageusement ressemblant à un cylindre, et d'une tête **(g)** de forme de solide trois dimensions, avantageusement ressemblant à une sphère ou demi-sphère, le diamètre (**sg**) de la tête **(g)** étant supérieur au diamètre (**st**) de la tige (**e**) et les éléments d'accrochage forment une étoile qui commence au centre de la base du module et sont liés par leur base à la base du module, **caractérisé en ce que** le dispositif d'accrochage est composé encore d'un raccord (**L**) pour lier au moins deux modules (**m**), chaque module (**m**), lorsqu'il est lié au raccord (**L**) tourne autour de son propre axe ou autour d'un axe commun (**d**) dans son propre plan ou dans les plans communs (**z**) de telle manière que l'espace (**k**) entre les têtes adjacentes (**g**) des modules adjacents **(m)** est variable.

**2.** Le dispositif auto-adhésif selon la revendication 1, **caractérisé en ce que** les éléments d'accrochage **(a)** ont des têtes (**g**) disposées d'une telle manière que la somme des diamètres de trois têtes adjacentes (**g**) est supérieure à la somme des distances entre elles et la longueur de la tige (**e**) est supérieure au diamètre et/ou la hauteur de la tête (**g**) et la distance minimum entre les têtes (g) est supérieure ou égale au diamètre de la tige (**e**).

**3.** Le dispositif auto-adhésif selon la revendication 1 ou 2, **caractérisé en ce que** la liaison entre les dispositifs est réalisée lorsque les têtes (**g**) des éléments d'accrochage (**a**) sont accroché l'un à l'autre et/ou les têtes (**g**) sont accrochées aux tiges (**e**) dans le cas où la somme des diamètres de trois têtes adjacentes **(g)** est inférieure à la somme des distances entre elles et la longueur de la tige (**e**) est supérieure au diamètre de la tête (**g**).

**4.** Le dispositif auto-adhésif selon la revendication 1 ou 2 ou 3, **caractérisé en ce que** le raccord (**L**) et le module (**m**) et les éléments d'accrochage (**a**) sont faits avec des matières de propriétés physiques différentes ou identiques, avantageusement avec des matières souples et élastiques dont le coefficient de frottement est faible et/ou avec des matières non souples.

**5.** Le dispositif auto-adhésif selon la revendication 1 ou 2 ou 3 ou 4, **caractérisé en ce que** les têtes **(g)** des éléments d'accrochage **(a)** ont des surfaces lisses et/ou avec rainures de telle manière qu'elles peuvent se lier avec les autres têtes [**a(1)**] du dispositif (**x**) du même type.

**6.** Le dispositif auto-adhésif selon la revendication 1 ou 2 ou 3 ou 4 ou 5, **caractérisé en ce que** les têtes **(g)** des éléments d'accrochage **(a)** ont des surfaces lisses et/ou des surfaces avec rainures parallèles (**t**) écartées l'une de l'autre de la largeur d'une rainure découpée.

**7.** Le dispositif auto-adhésif selon la revendication 1, **caractérisé en ce que** le raccord (**L**) est un solide trois dimensions, avantageusement de forme proche à un solide de révolution ou solide à base polygonale et qu'il lie les modules (**m**) de la façon qui permet leur rotation réciproque.

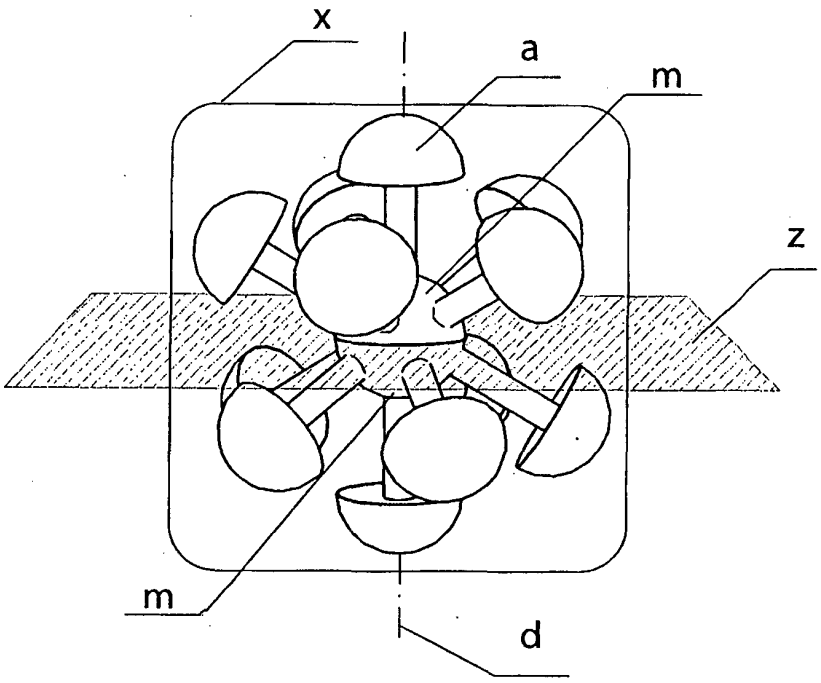



*Fig. 1*

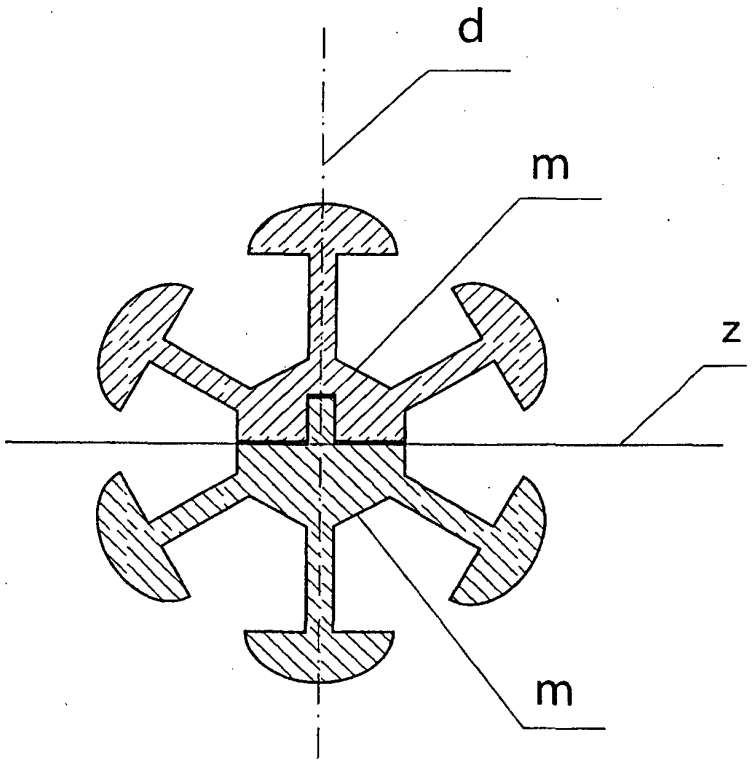



*Fig. 2*

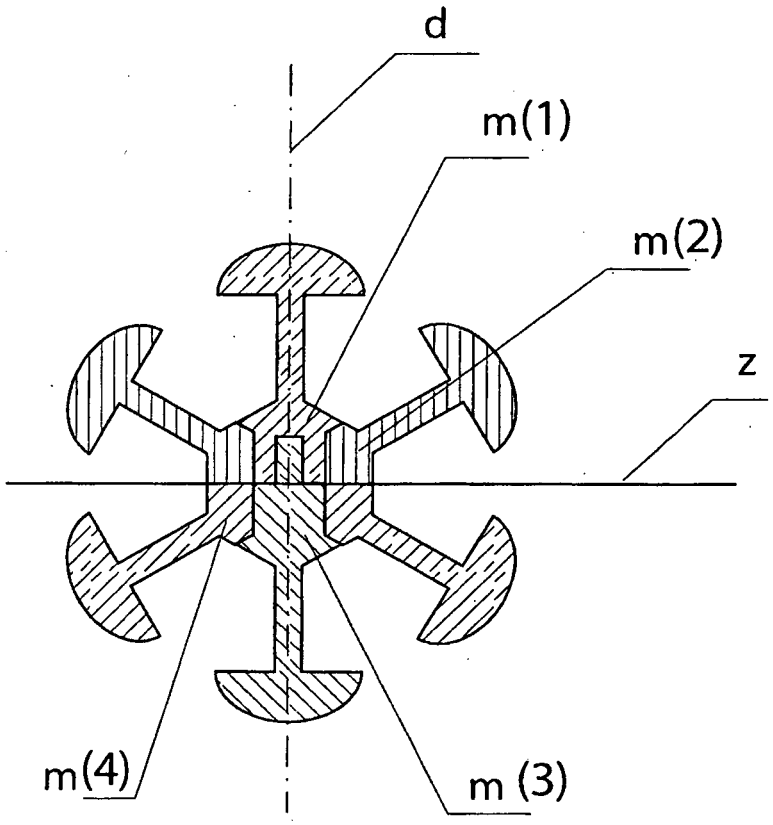



*Fig. 3*

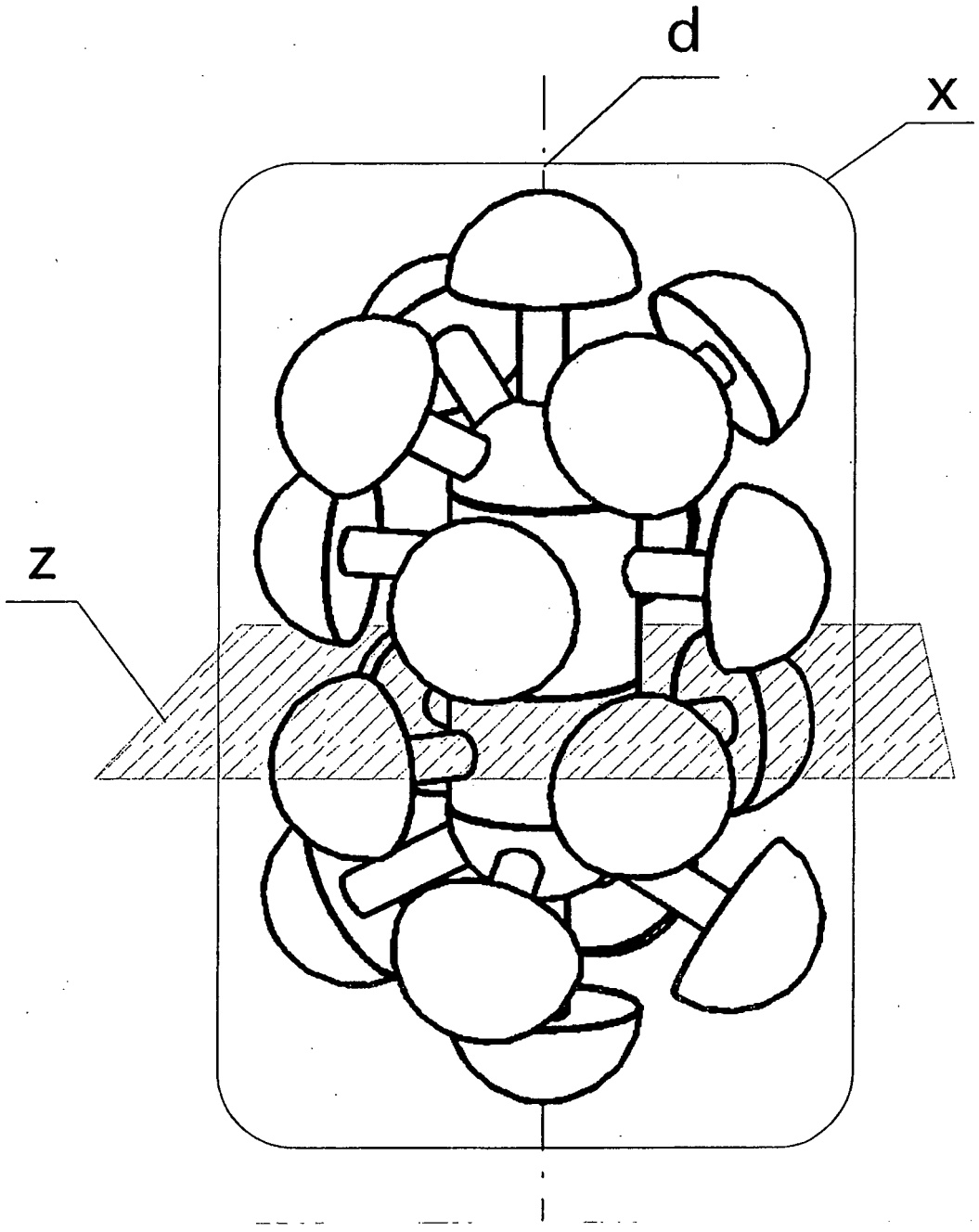



*Fig. 4*

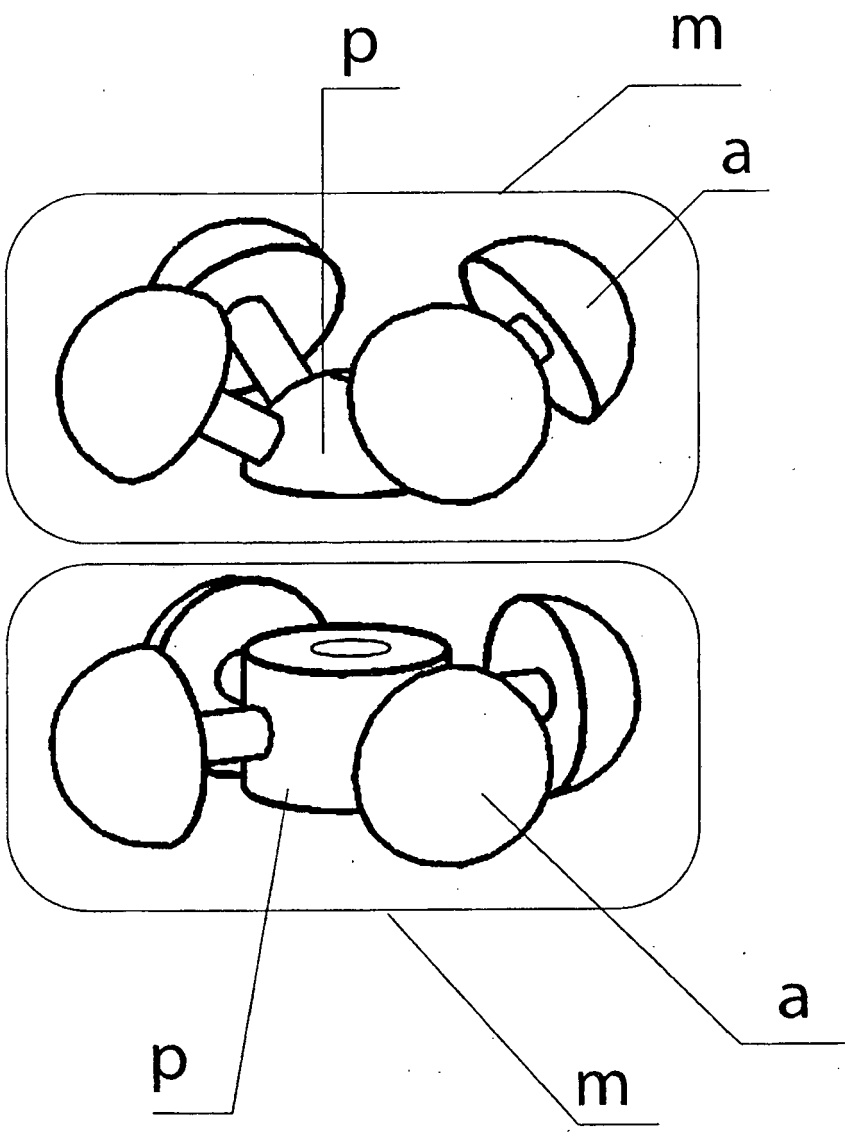



*Fig. 5*

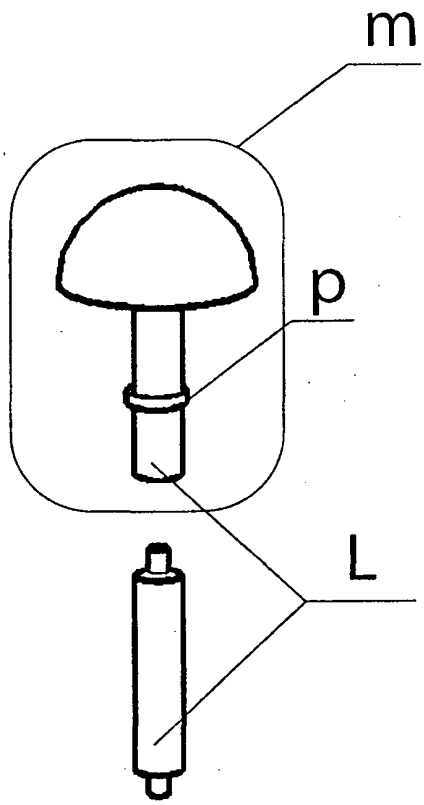



*Fig. 6*

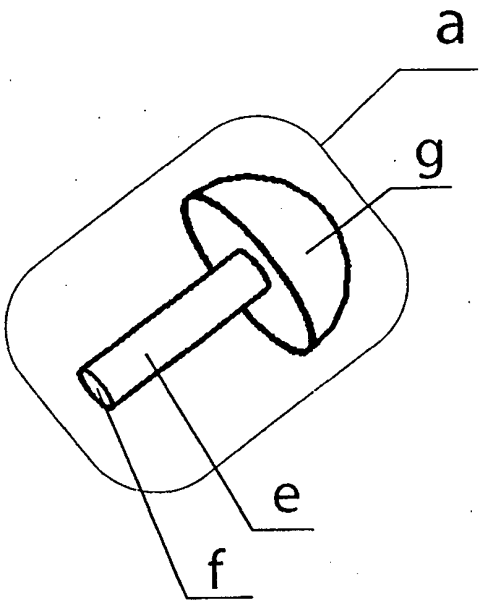



*Fig. 7*

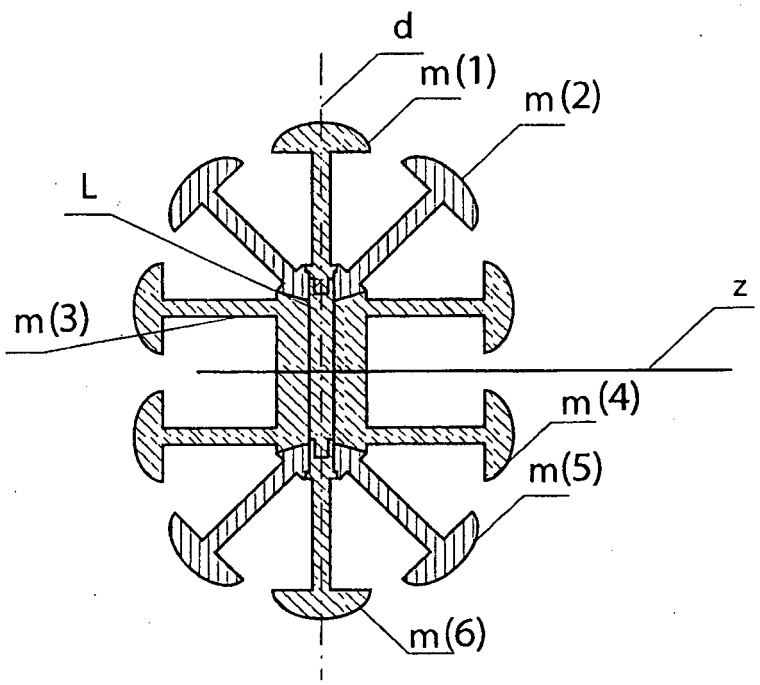



*Fig. 8*

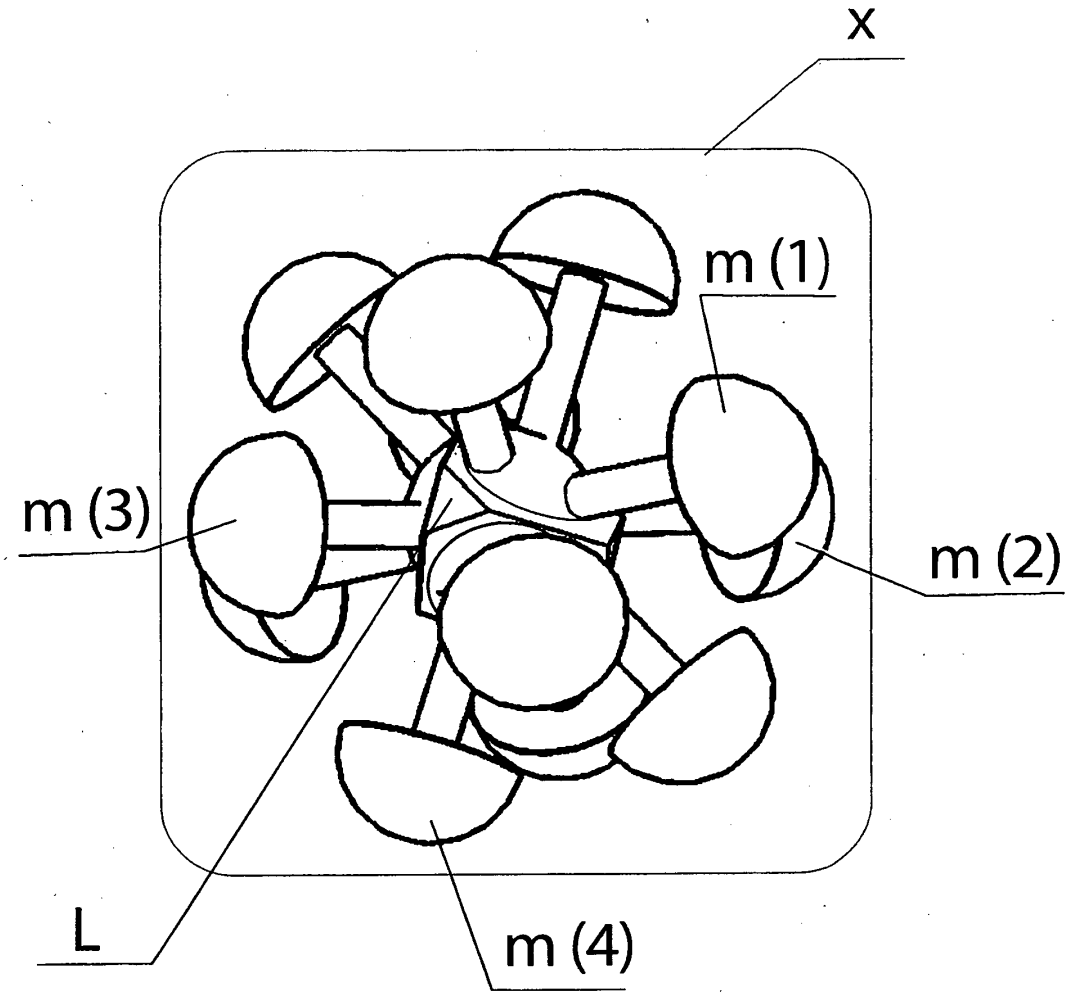



*Fig. 9*

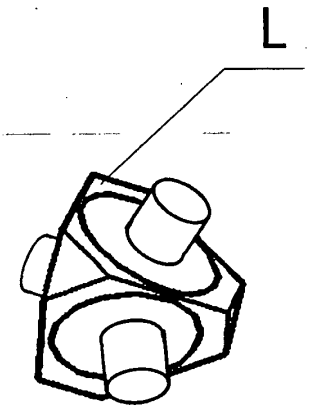



*Fig. 10*

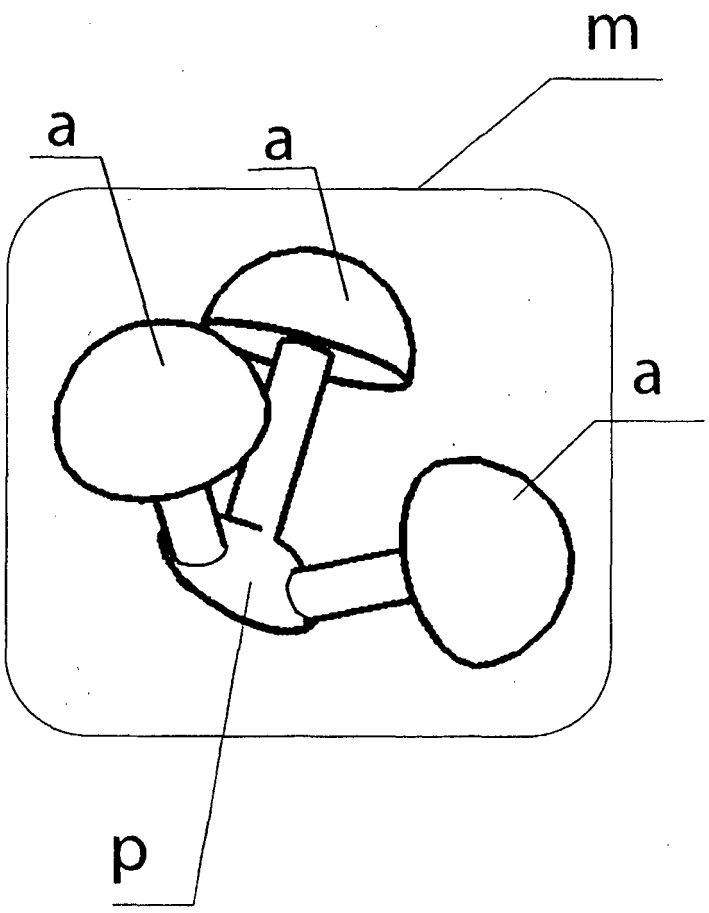



*Fig. 11*

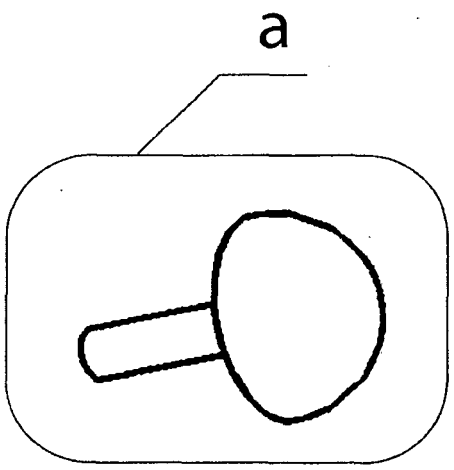



*Fig. 12*

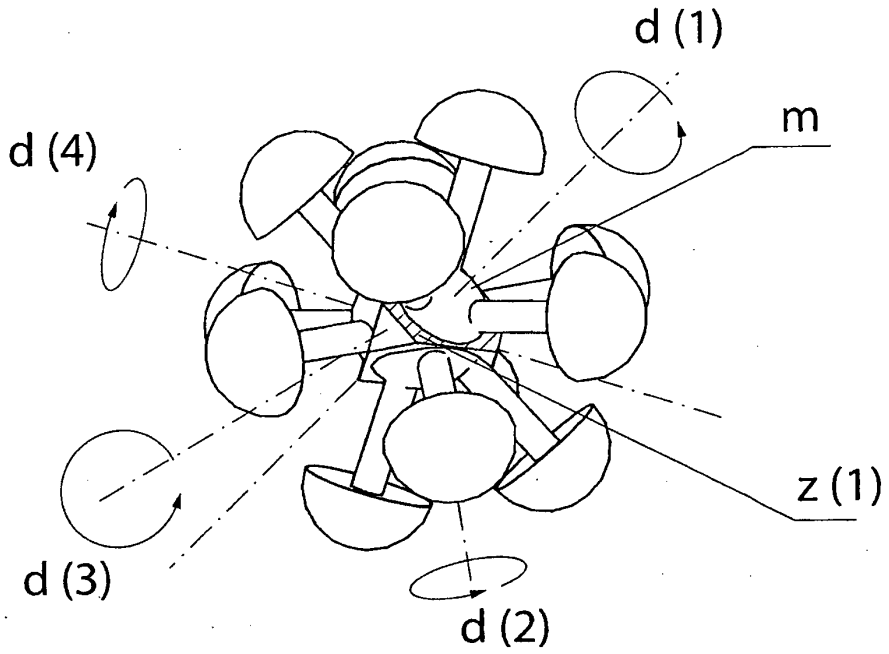



*Fig. 13*

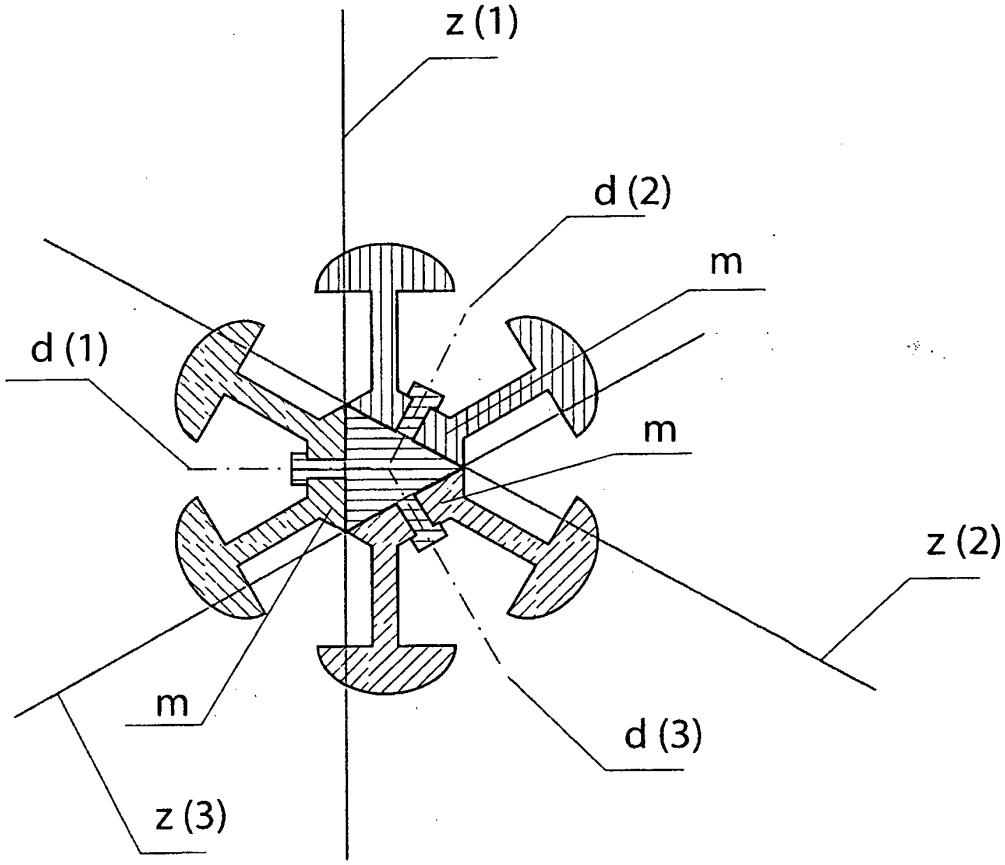



*Fig. 14*

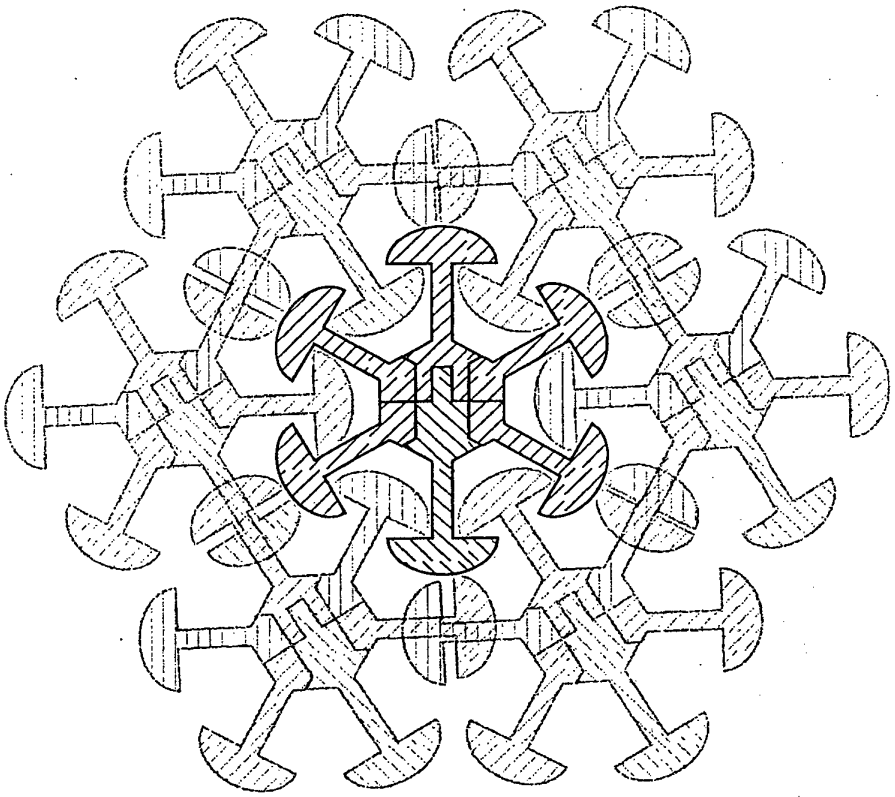


*Fig. 15*

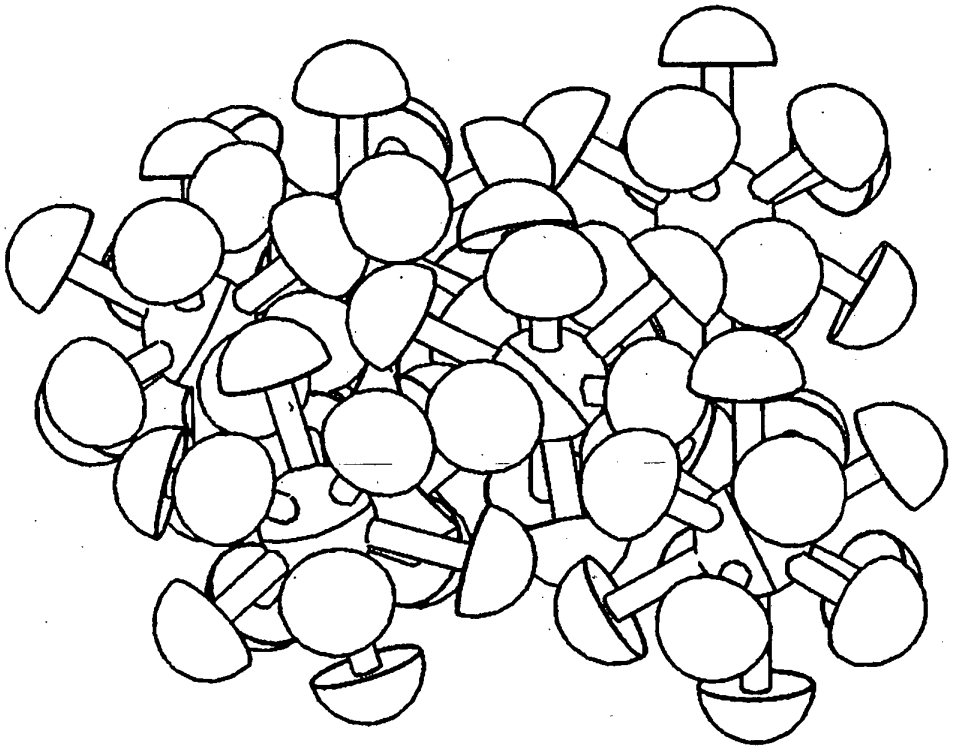


*Fig. 16*

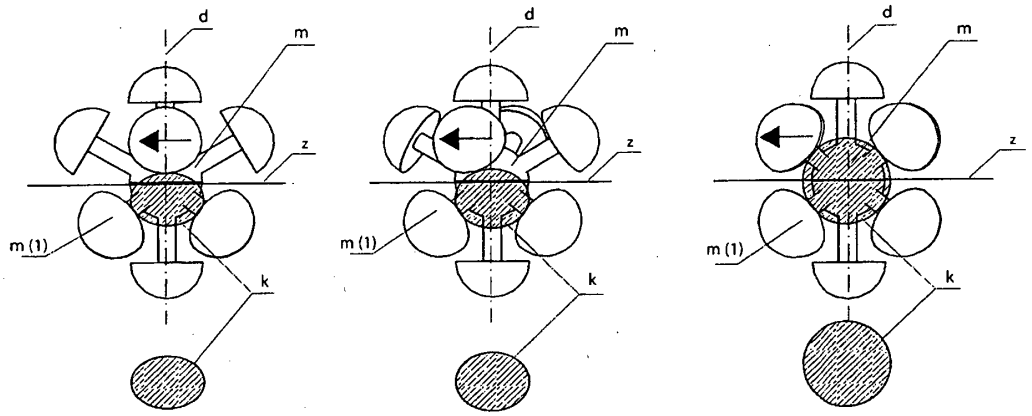



*Fig. 17*

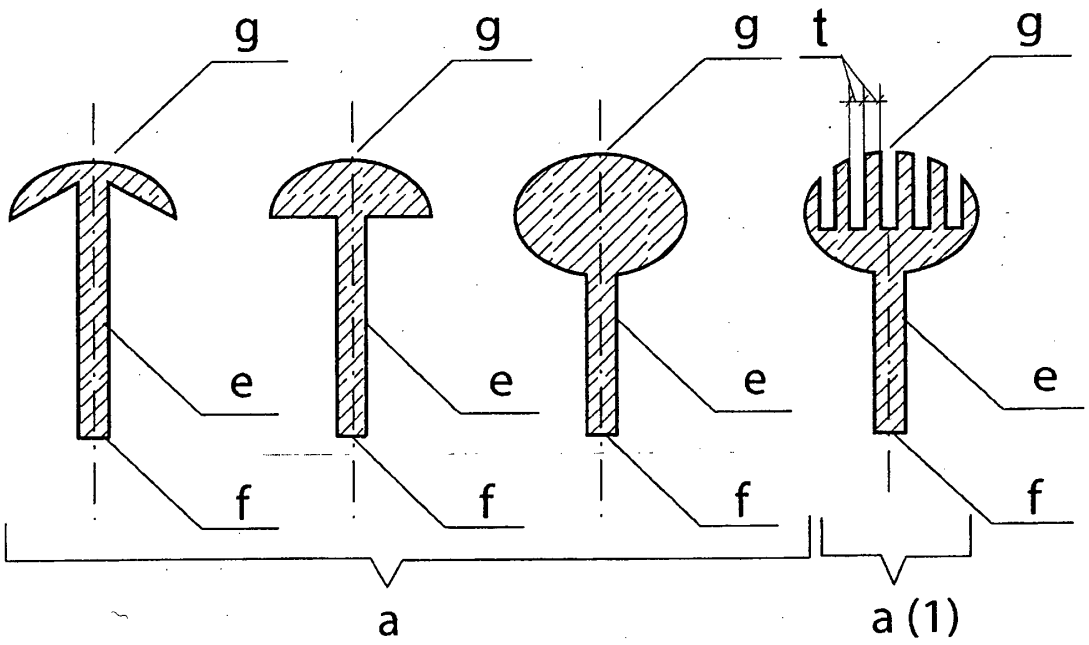



*Fig. 18*

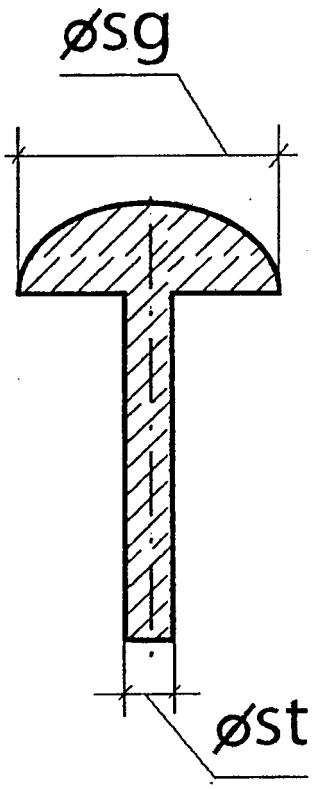



*Fig. 19*

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


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