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(54) **Multipurpose assembly with variable configuration**

(57) Multipurpose assembly with variable configuration, comprising at least one first member (2) made of a shape-memory material, having a first base configuration memorized at a transition temperature (T_H) of the material, the base configuration (C_b) being mechanically deformable to assume a modified configuration (C_m) memorized at temperatures lower than the transition temper-

ature (T_H). The assembly comprises at least one second member (3) made of a second non-shape-memory material connected to at least one first shape-memory member (2), the first shape-memory member (2) having at least one portion (5, 5') with a fixed configuration for stable connection with at least one second non-shape-memory member (3).

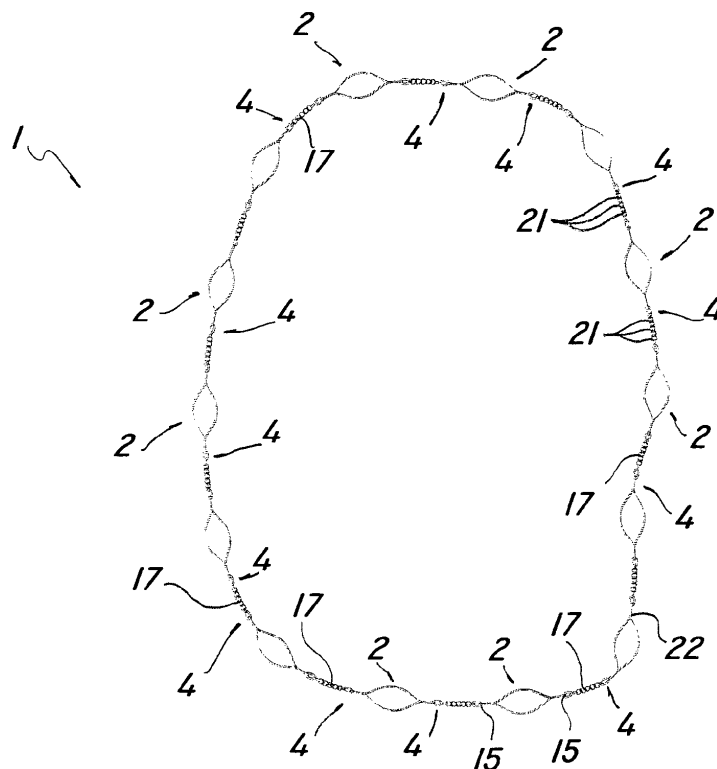


FIG. 1

Description

Field of the invention

[0001] The present invention generally finds application in the field of fashion and furniture accessories and particularly relates to a multipurpose assembly with a variable configuration.

Background art

[0002] A number of accessories are known in the field of jewelry and costume jewelry, which comprise a portion made of a shape-memory material.

[0003] Particularly, US2004/0020051 discloses a method of manufacturing jewels at least partially made of a shape-memory alloy, essentially comprising nickel and titanium and submitted to a predetermined thermal cycle during the manufacturing process, to acquire the desired thermomechanical properties.

[0004] A necklace is particularly disclosed, which is composed of a single thread made of a shape-memory alloy, supporting a pendant. The thread is open to allow a user to wear it and to assume a substantially closed elliptical configuration when heated above the transition temperature. Further exemplary embodiments of jewels are disclosed, which include a multi-thread braid or bundle, at least one of the threads being made of a shape-memory alloy.

[0005] One drawback of this prior art solution is that the shape-memory wire/s extend substantially throughout the length of the jewel.

[0006] Thus, if the temperature at which full transformation from martensite to austenite occurs is reached, the overall shape of the jewel may considerably differ from the previously imparted shape, thereby affecting the function and wearability of the jewel.

[0007] WO2012/001713 discloses a jewel comprising an elongate structure for supporting a plurality of decorative elements. The elongate support structure is formed from a pair of threads made of a shape-memory alloy, which are arranged substantially one alongside the other and are connected to each other at the longitudinal ends.

[0008] The decorative elements are strung onto the two threads and, excepting the first and the last, are free to slide along the threads.

[0009] In this prior art solution, since the shape-memory material extends substantially throughout the support structure, the overall shape of the necklace or bracelet may considerably vary according to temperature, which will considerably affect its exterior appearance and comfort of use in certain possible configurations.

[0010] US2004/0025984 discloses a jewel having two ends, movable between an open position allowing the user to put on the jewel, and a substantially closed position allowing the jewel to be worn after being put on.

[0011] Furthermore, at least one portion is made of a shape-memory alloy having a transition temperature

close to body temperature, such that the jewel automatically assumes the closed position once it has been put on, only due to the effect of the shape-memory alloy.

[0012] An apparent drawback of this prior art solution is that the passage from the open position to the closed position due to the shape-memory material occurs gradually, once the jewel is laid in contact with the body, whereby the action for stable wearing of the jewel turns out to be slow and inconvenient.

[0013] Furthermore, since the heat of the human body is required to reach a stable closed position, a jewel of this type may be hardly worn over a piece of clothing, such as a pullover.

[0014] EP1238600A1 discloses a device for use in jewelry pieces, comprising a first element made of a shape-memory alloy and a second element cooperating with the first element and adapted to provide a mechanical action to reduce the hysteresis associated with the change of state of the shape-memory material, between austenite and martensite.

[0015] Particularly, the cooperating second element can reduce the difference between the activation and deactivation temperatures of the shape-memory material.

[0016] One drawback of this prior art arrangement is that for proper operation, the jewel must always comprise the cooperating element, and this may complicate the overall mechanical construction and, in certain cases, reduce the aesthetic value of the jewel.

[0017] DE19934312 discloses a jewel at least partially made of a shape-memory material having a super-elastic behavior. The memory-shape portion is shaped as a cage element, which may consist of a longitudinally notched tube, or a plurality of shape-memory threads. The cage element is designed to stably contain pearls, stones or the like, once the transition temperature has been reached.

[0018] One drawback of this arrangement is that the shape-memory element is obtained from a tubular element. This manufacturing technique may provide a generally poorly flexible jewel. Such drawback is even more serious because the connection between the shape-memory element and the remaining portion of the jewel is substantially rigid.

[0019] FR2936686 discloses a jewel having a main portion made of a shape-memory material. Such main shape-memory portion may be obtained from a thread having rounded or rectangular section that can be inscribed in a circle having a radius of less than 10 mm or a thin strip having a thickness of less than 2 mm.

[0020] An apparent drawback of this prior art arrangement is that the shape-memory element forms the main body of the jewel, which is thus substantially rigid.

Disclosure of the invention

[0021] The object of the present invention is to overcome the above drawbacks, by providing a multipurpose assembly with a variable configuration, that has a high

resistance and is relatively cost-effective.

[0022] A main object of the present invention is to provide a multipurpose assembly with a variable configuration that can be easily deformed to meet various usage requirements and also be restored to a memorized configuration.

[0023] A further object of the present invention is to provide a multipurpose assembly with a variable configuration whose size may be adapted in a particularly easy manner, without requiring the overall shape of the object to be forcibly changed.

[0024] Another object of the present invention is to provide a multipurpose assembly with a variable configuration that is particularly convenient to put on.

[0025] Yet another object of the present invention is to provide a multipurpose assembly with a variable configuration that can be reused a great number of times to generate many configurations.

[0026] These and other objects as better explained hereafter, are fulfilled by a multipurpose assembly with a variable configuration as defined in claim 1.

[0027] With this particular configuration, the shape of the assembly may be easily modified and be later restored to the memorized configuration, simply by an appropriate heat exchange.

[0028] Preferably, the multipurpose assembly with a variable configuration may comprise a plurality of first shape-memory members connected in series with one another. This will allow the user to only modify the shape of certain first members and to select from a great number of possible deformed configurations.

[0029] Conveniently, each first shape-memory element may be connected to a second element via connection means. Thus, the shape change between the deformed configuration and the memorized configuration of the first members may be located in a plurality of spaced positions in the object, to obtain a change of the overall size of the assembly, without altering its overall shape.

Brief description of the drawings

[0030] Further features and advantages of the invention will become more apparent from the detailed description of a few preferred, non-exclusive embodiments of a multi-purpose assembly with a variable configuration of the invention, which are described as non-limiting examples with the help with the accompanying drawings in which:

FIG. 1 is a front view of a multipurpose assembly of the invention in a first preferred configuration with first members in a modified configuration;
FIGS. 2 and 3 are perspective views of a first detail of Fig. 1, in a base configuration and a modified configuration respectively;
FIGS. 4 and 5 are lateral views of a first member of Fig. 2, in a base configuration and a modified con-

figuration respectively;

FIG. 6 is a front view of an assembly of the invention in a second preferred configuration with first members in a modified configuration;

FIGS. 7 and 8 are front views of an assembly of the invention in a third preferred configuration with first members in a base configuration and in a modified configuration respectively;

FIGS. 9 and 10 are front views of an assembly of the invention in a fourth preferred configuration with first members in a base configuration and in a modified configuration respectively;

FIG. 11 shows a diagram of the shape properties as a function of the temperature of the shape-memory material.

Detailed description of a preferred embodiment

[0031] Particularly referring to the above figures, there is shown a multipurpose assembly with a variable configuration according to the invention, generally designated by numeral 1, which is designed to be used as a furniture accessory or a fashion accessory, for example a piece of jewelry or costume jewelry, such as a bracelet, a necklace, a ring or the like, or a pair of eyeglasses.

[0032] The figures show a multipurpose assembly with a variable configuration 1 which is designed to create different jewel configurations.

[0033] In its basic form, the assembly 1 comprises a first member 2 made of a shape-memory material, having a base configuration, referenced C_b , memorized at a predetermined transition temperature (T_H) of the material, which is connected to a second member 3 made of a second non-shape-memory base material.

[0034] Of course, the assembly may have a higher degree of complexity and comprise a certain number of first members 2 connected to a given number of second members 3 adjacent to the first members.

[0035] The base configuration C_b of the first member 2 is mechanically deformable at temperatures T below the transition temperature T_H to assume a modified configuration, referenced C_m .

[0036] According to a peculiar feature of the invention, the first shape-memory member 2 has at least one portion 5 with a fixed configuration for stable connection with the second non-shape-memory member 3.

[0037] Conveniently, the first member 2 and the second member 3 are mutually connected via appropriate connection means, generally referenced 4.

[0038] Advantageously, the presence of non-shape-memory parts, consisting of the second members 3 and the portion 5 of the first member 2, will provide assemblies 1 that maintain their functions and/or their degree of wearability substantially unaltered at any temperature, while having substantially differentiated shapes at temperatures below and above the transition temperature T_H .

[0039] Conveniently, the transition temperature T_H may be substantially close to the body temperature of

the user, such that the first member 2 has the base shape C_b when the assembly 1 is put on by the user.

[0040] Alternatively, the transition temperature T_H may be lower than the body temperature. For instance, the transition temperature T_H may be close to -5°C , 0°C , 5°C or 10°C .

[0041] Alternatively, or namely if the invention provides an assembly other than a piece of jewelry, the transition temperature T_H may be higher than the body temperature. In this case, the transition temperature T_H may be close to 35°C , 65°C or 95°C .

[0042] This may be obtained by appropriately changing the composition of the shape-memory alloy, and particularly the concentrations of the materials that compose it, or by changing the heat treatments applied to such alloy.

[0043] In a first embodiment of the invention, as shown in Figs. 1 to 6, the first member 2 may consist of an elongate strip 22 extending along a predetermined longitudinal axis L.

[0044] The strip 22 may comprise a central shape-memory portion 6 with fixed-configuration end portions 5, 5'.

[0045] Particularly, as shown in Figs. 2 and 4, the central portion 6 may comprise two substantially parallel and transversely offset longitudinal sections whose ends 9, 10; 11, 12 are joined at corresponding end portions 5, 5'.

[0046] The longitudinal sections 7, 9, at temperatures below the transition temperature T_H , may have a modified configuration, which is adapted to maintain the shape of the first member 6 substantially unchanged and flattened.

[0047] In this configuration, the longitudinal sections have corresponding inner edges 13, 14 in facing relationship and substantially in contact with each other.

[0048] As better shown in Figs. 3 and 4, at temperatures above the transition temperature T_H the longitudinal sections 7, 8 may be subjected to a mechanical modification, assisting their substantially transverse movement away from each other to separate the inner edges 13, 15 having a substantially curved shape, with respective radii of curvature R, R'.

[0049] The curvature of these longitudinal sections 7, 8 is such that the inner edges 13, 14 are at a maximum predetermined transverse distance $d_{\max}$, $d_{\max}'$ from the corresponding fixed-configuration portion 5, 5'.

[0050] Particularly, the maximum distance of the edges 13, 14 may be identical and range from 1 mm to 30 mm, preferably from 8 mm to 20 mm.

[0051] Thus, as a result of the movement of the edges 13, 14 of the longitudinal sections 7, 8 away from each other, the first plate-like member 2 may have a length l_1 , in the base configuration C_b , that is smaller than the length l_2 assumed thereby in the modified configuration C_m .

[0052] Particularly, the length may be smaller than a value ranging from 2% to 50% of the length l_2 , and particularly l_1 may be smaller than a value ranging from 10% to 300% of the length l_2 .

[0053] This configuration is merely provided by way of example of and without limitation to the present invention, such that the assembly 1 may comprise first members 2 having a base configuration and a modified configuration, which are substantially other than that described above, for causing thereon size changes other than those mentioned above.

[0054] Conveniently, according to an alternative configuration of the invention, not shown, the assembly 1 may comprise a plurality of first members 2 connected in series with one another.

[0055] Here, the assembly 1 comprises a portion made of at least one second member 3, which is adapted to connect the plurality of the first members 2 connected in series with one another.

[0056] In an alternative variant embodiment, as shown in the figures, each first member 2 may be interposed between a pair of second members 3 and be connected thereto via the connection means 4.

[0057] Thus, the shape change between the deformed configuration and the base configuration of the first members 2 may be situated in a plurality of spaced positions of the assembly 1.

[0058] In a further exemplary embodiment, not shown, the connection means 4 may be made of a flexible material.

[0059] As better shown in Figs. 2 and 3, the connection means 4 may have at least one degree of freedom to allow at least a relative rotation between each first member 2 and the second members 3 adjacent thereto.

[0060] As a non-limiting example, the connection means 4 may comprise at least one through hole 15 formed on each first member 2 or a pair of through holes 15 formed at the non-shape-memory ends 5, 5', which are designed to receive at least one ring 16 with a predetermined clearance.

[0061] The rings 16 may freely rotate in the holes 15 for mutual movement of the second member 3 relative to the first member 2.

[0062] Conveniently, the connection means 4 may have at least two degrees of freedom to allow at least two relative rotations between each first member 2 and the second members 3 adjacent thereto.

[0063] The flexibility of the connection means 4 or their degrees of freedom allow the assembly 1 to be modified due to the deformation of the first members 2 without altering or distorting their original shape.

[0064] Conveniently, the connection means 4 between the first members 2 and the second members 3 may comprise lock means, not shown, which are adapted to provide rigid connection of each ring 16 with a first adjacent member 2.

[0065] In this particular configuration, each ring 16 may be integral with a first member 2 adjacent thereto and inserted in a through hole formed in the other first member 2 adjacent thereto, with a certain clearance.

[0066] In a further exemplary embodiment, as shown in Figs. from 1 to 6, each second member 3 may comprise

at least one pair of rings 16 and an elongate member 17 of the chain or thread type, connected at their longitudinal ends to the pair of rings 16.

[0067] The pair of rings 16 may be configured to fit into the corresponding holes 15 of the first member 2 with a predetermined clearance.

[0068] Conveniently, the second members 3 may have equal lengths, as shown in Fig. 1.

[0069] Alternatively, as better shown in Fig. 6, the second members 3 may have different lengths, to create assemblies 1 having different geometric and aesthetic characteristics.

[0070] Particularly, in the necklace having a modifiable geometry as shown in Fig. 6, the second member 3 placed above may be an undeformable chain designed to contact the user's neck.

[0071] Conveniently, the second members 3 may be made of a flexible material, such as a polymeric or natural material.

[0072] Furthermore, the second members 3 may have a preferred elongation in a longitudinal direction, such that the overall flexibility of the assembly 1 is increased.

[0073] Advantageously, as shown in Figs. 7 to 10, the first member 2 may have a substantially thread-like shape and the non-shape-memory portion 5 may comprise one or more flexible threads.

[0074] The assembly 1 may comprise a pair of free ends 19, 20, comprising the second members 3 connected to corresponding non-shape-memory portions 5, 5' of the first member 2.

[0075] Thus, a plurality of decorative elements 21 may be hooked or slideably strung on the first thread-like member 2, and be held at the ends 19, 20 by the second members 3.

[0076] Conveniently, the first members 2 may have a preferred elongation in a longitudinal direction, such that the overall flexibility thereof is increased.

[0077] In one exemplary, non-limiting aspect of the invention, as shown in Figs. 7 and 8 and in Figs. 9 and 10, the assembly 1 may comprise first members 2 having a modified shape, representing figures, words or symbols, whereas their base shape may be a substantially curved or thread-like shape.

[0078] The base material of the first members 2 may be selected from the group comprising nickel-titanium alloys, whose full transition temperature T_H between martensitic and austenitic phases coincides with the predetermined transition temperature.

[0079] Conveniently, the decorative elements 21 may be selected from the group comprising beads, disk-shaped elements, annular elements or other types of elements adapted to be strung or hooked on to the substantially thread-like first member 2.

[0080] Furthermore, the decorative elements 21 may be made of precious materials, including gold, silver, precious stones or the like, and may exhibit surface works designed to improve their finish or allow setting of one or more precious stones.

[0081] Also, the first member 2, the second member 3 and the connection means 4 may undergo an aesthetic surface coating process, for instance plating with a precious alloy or a dyeing alloy, obtained by galvanic processes or other types of treatments as commonly used in the field of jewelry.

[0082] The above disclosure clearly shows that the assembly with modifiable geometry of the invention fulfills the intended objects and is particularly adapted to be easily modified by the user according to his/her taste or requirements and to be later restored to a memorized shape simply by appropriate heating.

[0083] The assembly of this invention is susceptible of a number of changes and variants, within the inventive principle disclosed in the appended claims. All the details thereof may be replaced by other technically equivalent parts, and the materials may vary depending on different needs, without departure from the scope of the invention.

[0084] While the assembly has been described with particular reference to the accompanying figures, the numerals referred to in the disclosure and claims are only used for the sake of a better intelligibility of the invention and shall not be intended to limit the claimed scope in any manner.

Claims

1. A multipurpose assembly with variable configuration, for use in the field of accessories for fashion and home appliances, comprising at least one first member (2) in a shape-memory material, having a first base configuration (C_b) memorized at a transition temperature (T_H) of the material, which based configuration (C_b) is mechanically deformable to assume a modified configuration (C_m) memorized at a temperature lower than the transition temperature (T_H); wherein the assembly comprises at least one second member (3) made of a second non shape-memory material connected to said at least one first shape-memory member (2), said at least one first shape-memory member (2) having at least one portion (5, 5') with a fixed configuration to allow a stable connection with said at least one second not memory-shaped member (3); **characterized by** comprising a plurality of first shape-memory members (2) connected with a plurality of said second members (3) at adjacent positions through appropriate connection means (4).
2. Assembly as claimed in claim 1, **characterized in that** said connection means (4) are made of a flexible material.
3. Assembly as claimed in claim 2, **characterized in that** said connection means (4) are adapted to promote at least one freedom degree to allow at least

a relative rotation between each of said first members (2) and each of said the second members (3).

4. Assembly as claimed in claim 3, **characterized in that** said connection means (4) are adapted to promote at least two freedom degrees to allow at least two relative rotations between each of said first members (2) and said second member (3) in adjacent position. 5
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5. Assembly as claimed in claim 4, **characterized in that** said connection means (4) comprise at least one through hole (15) formed on each of said first members (2), and at least one ring (16) inserted in said through hole (15) with a predetermined clearance. 15
6. Assembly as claimed in claim 1, **characterized in that** each of said fixed configuration portions (5, 5') of said first member (2) are made in a flexible material and has a preferred elongation along a longitudinal direction (L). 20
7. Assembly as claimed in claim 6, **characterized in that** said fixed configuration portions (5, 5') comprise one or more flexible threads. 25
8. Assembly as claimed in claim 6, **characterized in that** said fixed configuration portions (5, 5') comprise one or more decorative members (21) hooked or slidably stringed on said flexible threads. 30
9. Assembly as claimed in any of the preceding claim, **characterized in that** said first member (2) comprises at least one first strip (22) made of a shape-memory material extending along a longitudinal axis (L) and having curved shape with predetermined radius of curvature (R, R') in said base configuration (C_b). 35
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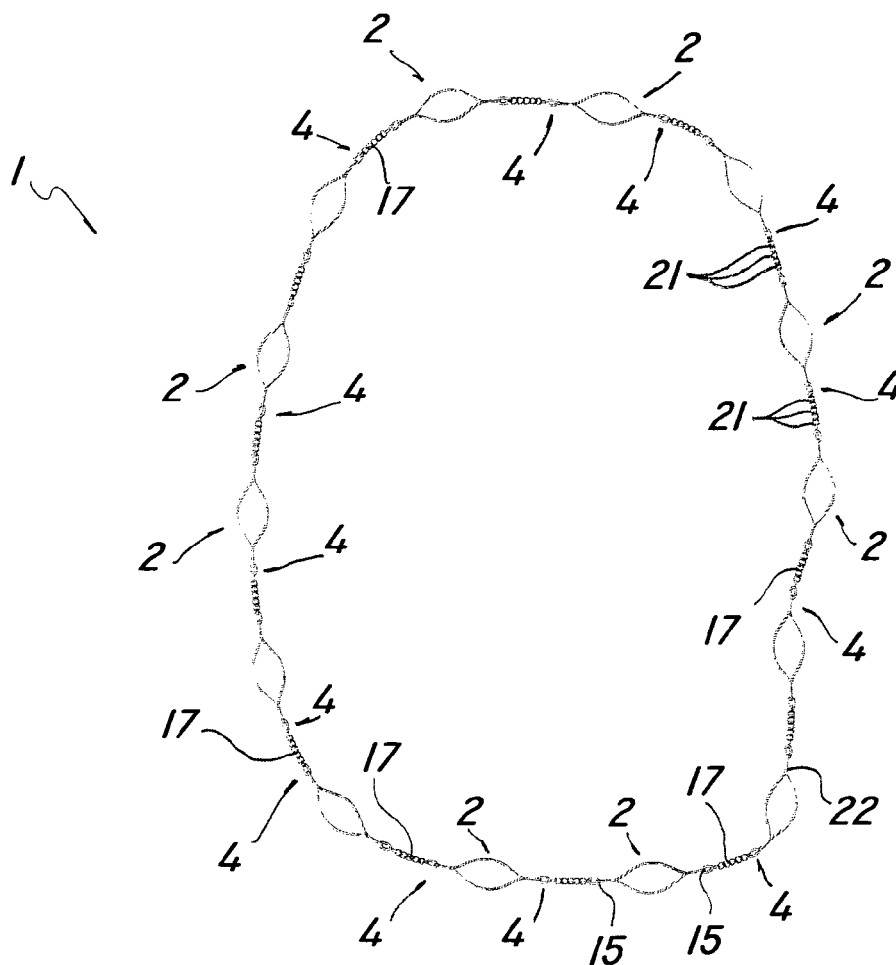


FIG. 1

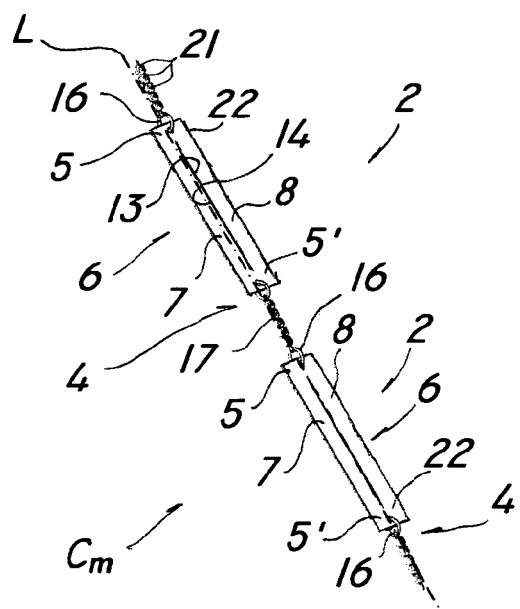


FIG. 2

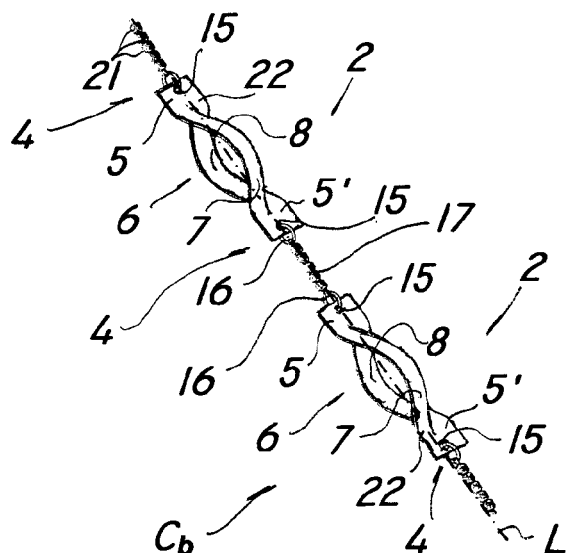


FIG. 3

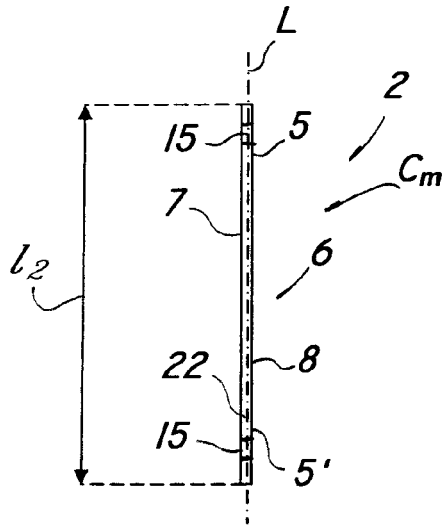


FIG. 4

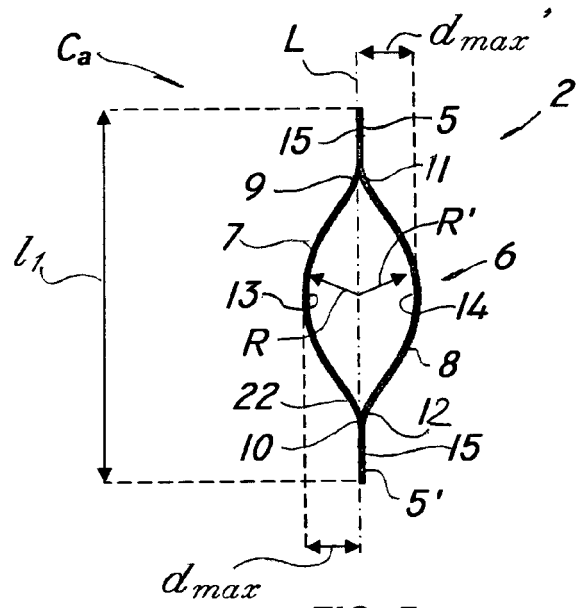


FIG. 5

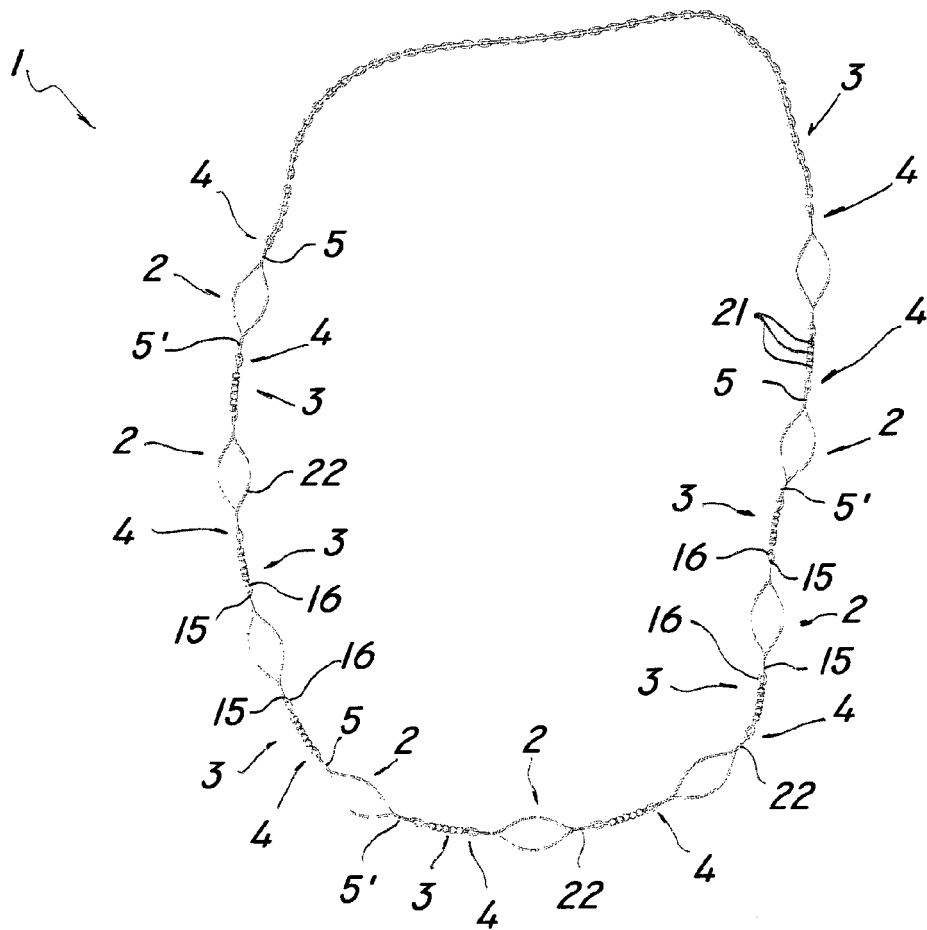


FIG. 6

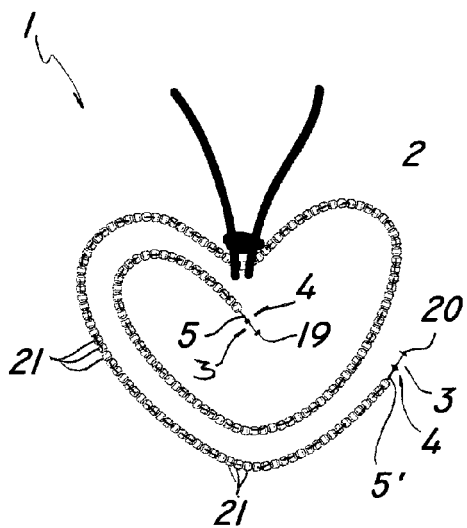


FIG. 7

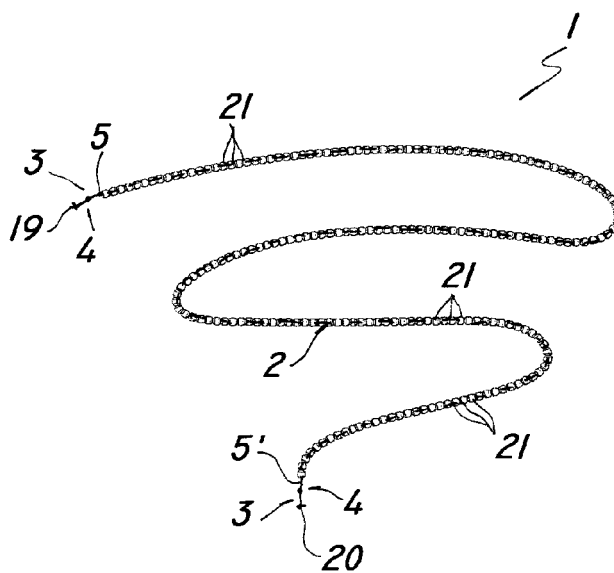


FIG. 8

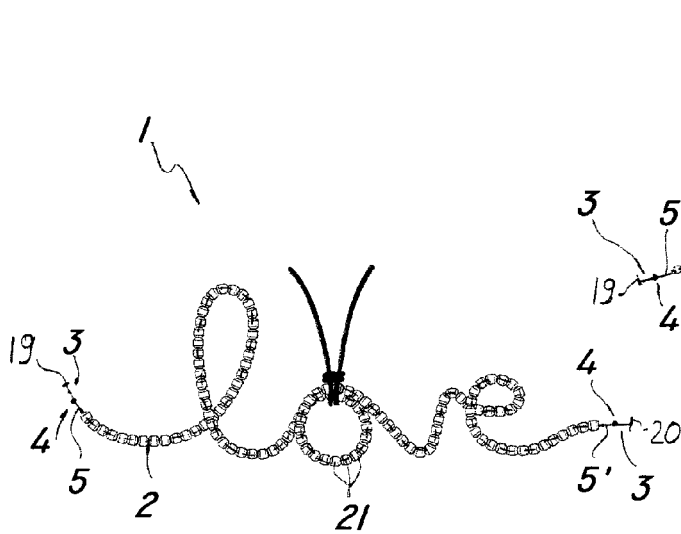


FIG. 9

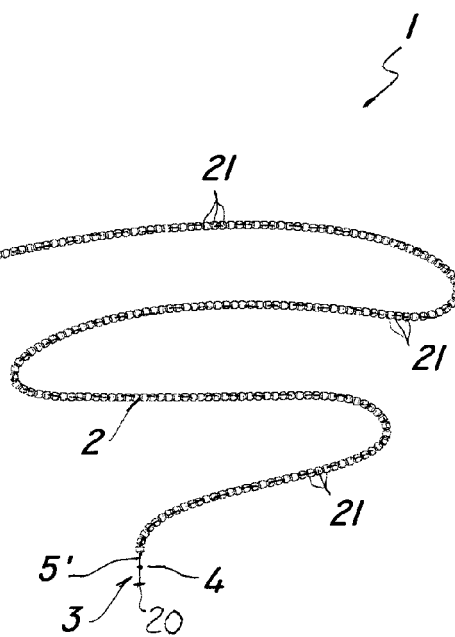


FIG. 10

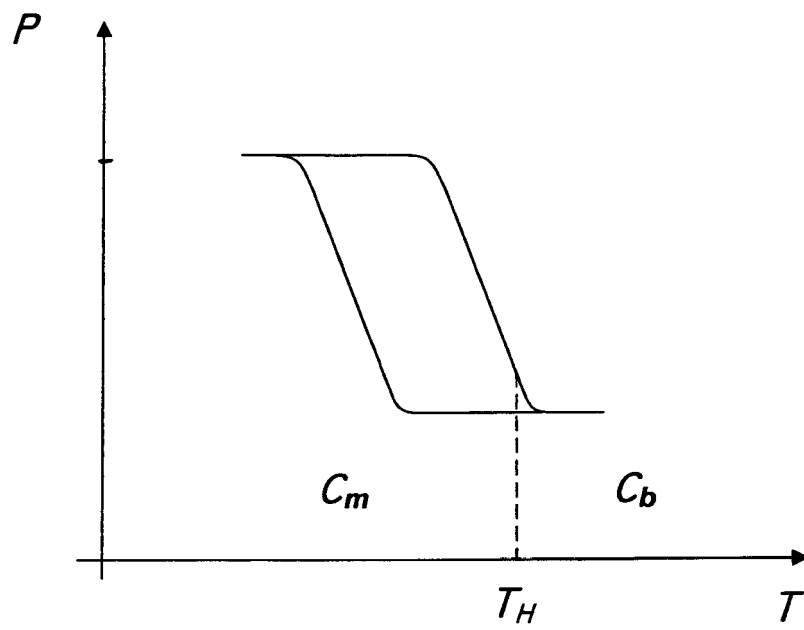


FIG. 11



EUROPEAN SEARCH REPORT

Application Number
EP 13 00 3357

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Place of search The Hague		Date of completion of the search 13 September 2013	Examiner Simpson, Estelle
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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