United States Patent [19]

Brumlik

[11] **3,921,259**

[45] **Nov. 25, 1975**

[54] **SELF-GRIPPING DEVICE WITH COMPOSITE GRIPPING ELEMENTS**

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[22] Filed: **Nov. 21, 1974**

[21] Appl. No.: **525,908**

Related U.S. Application Data

[63] Continuation of Ser. No. 396,641, Sept. 12, 1973, which is a continuation of Ser. No. 166,955, July 28, 1971.

[52] **U.S. Cl.** **24/204;** 85/13; 85/21

[51] **Int. Cl.²** **A44B 17/00**

[58] **Field of Search** 24/204; 85/13, 21

[56] **References Cited**

UNITED STATES PATENTS

874,611	12/1907	Mortimore	85/21
3,166,072	1/1965	Sullivan	24/204
3,236,142	2/1966	Bradway	85/21
3,408,705	11/1968	Kayser	24/204
3,490,107	1/1970	Brumlik	24/204
3,494,006	2/1970	Brumlik	24/204

FOREIGN PATENTS OR APPLICATIONS

589,380	3/1959	Italy	24/204

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Attorney, Agent, or Firm—Burgess, Dinklage & Sprung

[57] **ABSTRACT**

A plurality of composite gripping elements are stiffly attached at their lower ends in an upright fashion to a base member. The composite gripping elements include a shaft preferably metallic having a modulus of elasticity such that it substantially retains or regains its upright position when shearing, compressive or tensile forces are applied thereto. At the upper end of the shaft is attached a distinct head element preferably of a different material from the shaft and having a penetrating and gripping shape which is adapted to enter and become lodged in a receiving surface or layer. The head element has a shape which describes a cone or truncated cone when the head is rotated about the vertical axis of the shaft. Also the lower portion of head preferably describes at least one hollow conical shape when so rotated. The head element is further characterized as having a degree of hardness and a mass so as to facilitate penetration into a receiving surface upon connection therewith.

4 Claims, 12 Drawing Figures

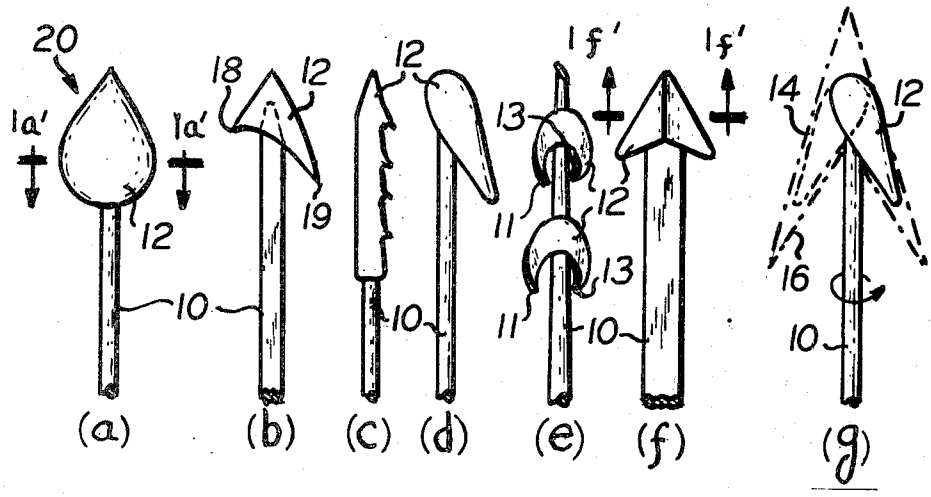


FIG. 1.

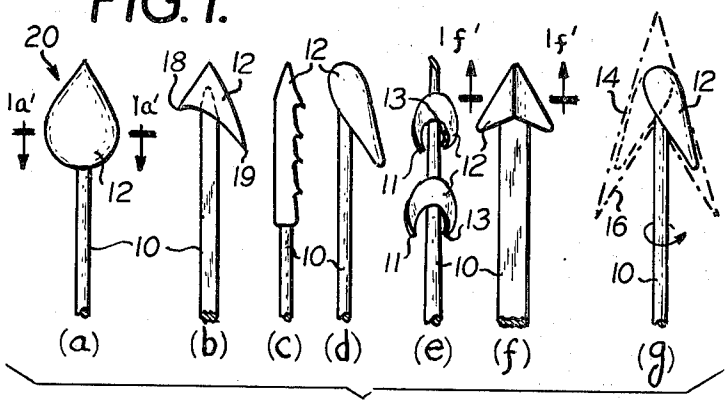


FIG. 1a'.

FIG. 1f'.

FIG. 3.

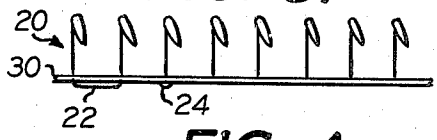


FIG. 4.

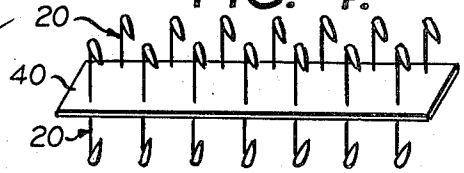


FIG. 2.

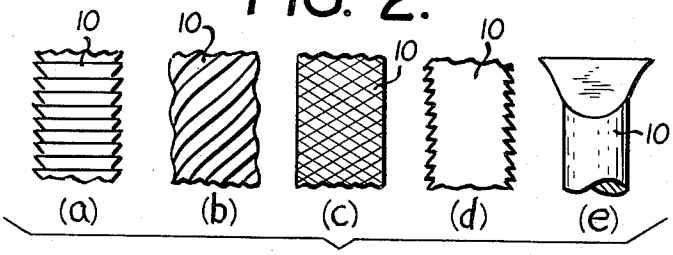


FIG. 5.

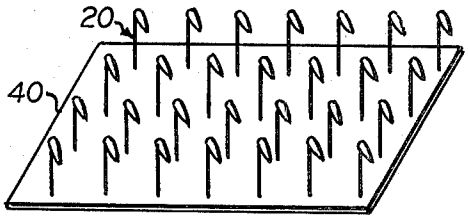


FIG. 7.

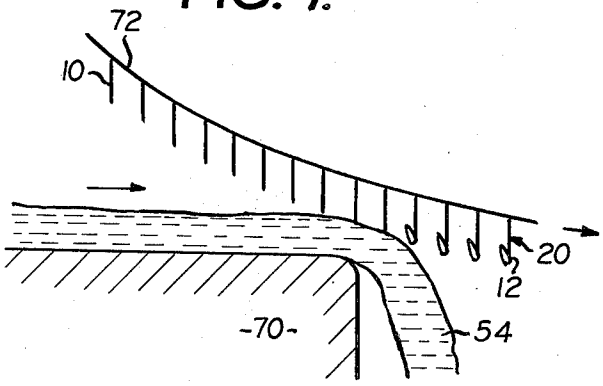


FIG. 6.

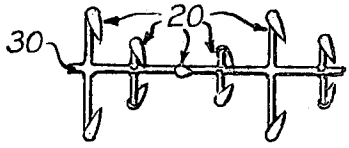


FIG. 9.

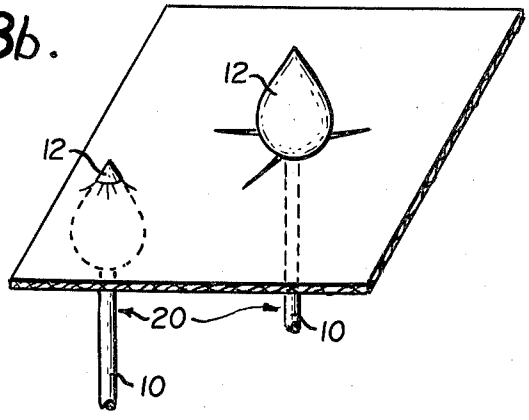


FIG. 8a.

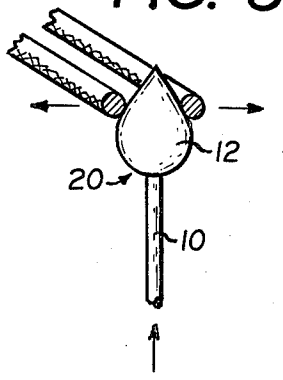
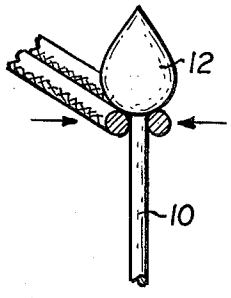


FIG. 8b.



SELF-GRIPPING DEVICE WITH COMPOSITE GRIPPING ELEMENTS

This is a continuation of application Ser. No. 396,641 filed Sept. 12, 1973 which in turn is a continuation of application Ser. No. 166,955 filed July 28, 1971.

BACKGROUND

This invention relates to a self-gripping device made up of a plurality of composite gripping elements stiffly attached in an upright position to a base member. More particularly, this invention relates to such a self-gripping device wherein the composite gripping elements are made up of a metallic shaft and a distinct head element of a material different from the shaft.

The gripping elements of presently available fasteners are of a homogeneous nature, that is, the shaft and penetrating hook of these elements are made from the same material. This integral arrangement, however, has several distinct disadvantages. If the gripping element, for instance, is made of a hard, brittle material which will facilitate penetration into a receiving surface, the shaft of the gripping element then becomes susceptible to breakage from shearing and tensile forces applied to the already lodged gripping elements. On the other hand, if the gripping element is made of a resilient material, which will withstand shearing and tensile forces, then the gripping element fails to penetrate and engage because it becomes susceptible to deflection when compressive forces are encountered in lodging the gripping elements in a receiving surface.

SUMMARY

The self-gripping device of the present invention, which includes a plurality of composite gripping elements overcomes the disadvantages met with prior gripping elements and provides maximum efficiency during connecting of the of the self-gripping device plus greatly improved strength once the device is joined with a receiving surface. In addition, the composite gripping elements provide a much greater control with respect to the shape and orientation of the head element as compared to integral gripping elements. Also the composite gripping element makes it possible to achieve the best combination of properties desired for particular applications for both the shaft and the head element.

The self-gripping device of the present invention comprises a plurality of composite gripping elements stiffly attached in an upright fashion in a random or uniform pattern to a base member. The composite gripping element comprises an upright shaft, preferably metallic, having a modulus of elasticity such that it resists deflection from its upright position when shearing, tensile or compressive forces are applied thereto. The shaft has attached at its upper end a distinct head element preferably of a material different from that of the shaft having a penetrating and gripping and/or retaining shape adapted to enter and become lodged in a receiving surface. The head element has a shape that describes a cone or truncated cone when the head is rotated about the vertical axis of the shaft. This general conical shape is attributable to the penetrating shape of the head element which also preferably describes in its lower portion at least one hollow cone when rotated as above. This preferred hollow cone is attributable to the gripping shape of the head element.

The head is further characterized by a degree of hardness and a mass which facilitates penetration of the gripping element into a receiving surface upon connection therewith.

The present invention also includes a process for forming the composite gripping elements which comprises contacting a metallic shaft having the characteristics described above with a molten material for a period of time sufficient to form a head or globule of said molten material on the shaft, withdrawing the shaft and head from the molten material and thereafter cooling or post-heating and/or post-forming to form a head having the penetrating shape desired. The head may also assume the desired shape upon withdrawal from the molten material.

DESCRIPTION OF THE DRAWING

FIGS. **1***a* through **1***f* are enlarged elevational views of composite gripping elements according to the present invention illustrating various penetrating and gripping shapes for the head elements and various crosssectional shapes for the shaft.

FIGS. **1***a'* and **1***f'* are cross-sectional views taken along lines **1***a'* and **1***f'* of FIGS. **1a** and **1f,** respectively.

FIG. **1***g* is an elevational view of the gripping element of FIG. **1***d* shown rotated about the vertical axis of the shaft to generate an outer penetrating cone and an inner hollow gripping cone, both cones being shown by dotted lines.

FIGS. **2***a* through **2***e* are side elevational views, partially broken away of various profiles for the upright shaft.

FIG. **3** is a side elevational view showing the composite gripping elements of the invention attached to a base member in an upright fashion.

FIGS. **4** and **5** are perspective views showing gripping elements of the invention uprightly attached to planar base members.

FIG. **6** is a perspective view showing an alternate embodiment of a self-gripping device of the invention wherein two headed crossed pairs of composite gripping elements are attached to a linear base member.

FIG. **7** illustrates a suitable arrangement for carrying out the method for the invention.

FIGS. **8***a* and **8***b* are perspective views illustrating the way in which the gripping element of FIG. **1***a* penetrates and grips or is retained by a fibrous receiving layer.

FIG. **9** is a perspective view illustrating the way in which the gripping element of FIG. **1***a* penetrates and is retained by a sheet-like receiving layer such as corrugated cardboard.

DESCRIPTION

Referring to FIG. **1** of the drawing, several embodiments of the composite gripping elements are shown. The composite gripping elements are identified generally by the reference numeral **20,** the shafts by the reference numeral **10** and the head elements by the reference numeral **12.**

In FIG. **1***a* the head **12** has a general teardrop configuration which is preferably generally flat in cross-section as shown in FIG. **1***a'*.

FIG. **1***b* shows a head element **12** having a first gripping barb **18** and a second gripping barb **19.** The first barb **18** is designed to permit removal of the composite gripping elements when the head **12** does not fully penetrate a receiving layer. This is known as releasable

self-gripping. The second barb **19** is designed to provide permanent self-gripping when the head **12** fully penetrates a receiving layer. The head element **12** of FIG. **1***b* may also be provided with a cutting edge to facilitate penetration and also preferably is a generally flat profile in cross-section.

In FIG. **1***c* the head **12** is an elongated pointed member having a plurality of barbs thereon. This particular head **12** because of its elongated shape may be generally round in cross-section.

In FIG. **1***d*, the head **12** is shown having an elongated shape having rounded portions at the penetrating and gripping end thereof.

In FIG. **1***e*, two head elements **12** are shown to comprise a generally crescent shape having pointed ends **11** which are twisted to point generally forwardly and ends **13** which are twisted to point generally rearwardly as shown. Also in FIG. **1***e* the end of the shaft **10** is exposed, that is it protrudes upwardly from the head **12** and may have a pointed end as shown or it may be rounded as shown in FIG. **1***b* or it may be flattened or bulbous as shown in FIG. **2***e*. This embodiment facilitates initial penetration into a receiving layer and may be employed with the gripping elements of the invention generally such as those shown in FIG. **1***a* through *d* and *f*. The same holds true with respect to using two or more head elements **12** on the same shaft.

In FIG. **1***f* the head **12** is shown to have an arrow configuration which is diamond shaped in cross-section as shown in FIG. **1***f'*. The edges of the head **12** in FIG. **1***f* may also be cutting edges to facilitate penetration in a receiving layer.

The head elements **12** shown in FIG. **1**, while they appear to vary widely in shape, have one and in most cases two common characteristics. If the heads **12** are rotated about the vertical axis of the shaft **10** as shown in FIG. **1***g* with respect to the gripping element of FIG. **1***d*, the head **12** generates or describes an outer cone or truncated cone which is indicated generally by dotted lines **14** and an inner hollow cone indicated generally by the dotted lines **16.** The outer cone **14** is attributable to the penetrating character of the head elements and the inner cone **16** is attributable to the gripping and retaining character of the head elements **12.** Each of the head elements shown in FIG. **1** when rotated will describe an outer cone or truncated cone and the gripping elements of FIGS. **1***d* and **1***f* will describe a single inner cone. The gripping elements of FIGS. **1***b*, *c* and *e* will generate a plurality of inner gripping cones. The gripping element of FIG. **1***a* will only describe an outer penetrating cone. However, the head element **12** of FIG. **1***a* although it will not generate an inner cone nevertheless still is characterized by a gripping or retaining shape by virtue of its teardrop profile.

A relative sharpness or roundness of the upper penetrating portion of the head elements **12** and the lower gripping portions may vary depending on the ultimate use of the gripping elements. A rounded upper portion as shown in FIG. **1***d*, for example, is preferred for minimizing irritation on contact with the skin and is especially suited for penetrating fibrous receiving layers. A pointed upper portion is shown in Examples for FIG. **1***b* and *c* and is more suited for piercing and penetrating non-fibrous materials such as sponge, paper, plastic film and the like.

The mechanisms of penetrating and gripping or retaining as mentioned above are illustrated in FIGS. **8** and **9.** In FIGS. **8***a* and **8***b* the gripping element of FIG. **1***a* is shown penetrating a fibrous receiving layer and illustrates the separation of two fibers which tend to return to their original position as shown in FIG. **8***b* by virtue of secondary force resulting from intertwining and interweaving of the fibers.

In FIG. **9,** the gripping element of **1***a* is shown initially penetrating a non-fibrous receiving layer and fully penetrating and retained thereby.

The shaft **10** may have a variety of shapes in crosssection as well as external profiles. In FIGS. **1***a*, *c*, *d*, and *e* the cross-section is shown as round and in FIG. **1***e* it is slightly tapered upwardly. In FIG. **1***b*, the shaft is generally square and in FIG. **1***fit* is generally flat and ribbon-like.

FIGS. **2***a* through *d* illustrate various external profiles for the shaft which are useful for securing good adhesion between the head elements **12** in the shaft **10.** In FIG. **2***a* the profile has a series of truncated cones. In FIG. **2***b* it is helical. In FIG. **1***c* it is crisscrossed and in FIG. **2***d* it is notched. In FIG. **2***e* the shaft **10** has an enlarged upper end such as results when wire is cut.

In FIGS. **3, 4, 5** and **6,** the manner in which the gripping elements **20** are attached to a base member is illustrated. In FIGS. **3** and **6,** the base member **30** is generally linear such as a filament or tape and in FIGS. **4** and **5** the base member **40** is planar. In general, the gripping elements **20** are stiffly attached in an upright fashion to the base in a random, uniform or predetermined pattern with the heads **12** in a uniform, random or predetermined pattern with respect to each other. Thus, the gripping elements **20** may be adhered to the base, may penetrate therein or may pass completely therethrough. The latter is illustrated in FIG. **3** wherein member **22** forms a staple-like configuration between two gripping elements **20.** An alternate approach involves the use of a stop member **24** on the end of a gripping element shown in FIG. **3.** In FIG. **4,** the gripping elements **20** extend from both sides of the base **40** and in FIG. **5** from only one side.

In FIG. **6** the gripping elements **20** are formed integrally with the base **30** from metal for example using known stamping or etching techniques. In this embodiment the gripping elements **20** radiate about the base **30** in a random or uniform fashion, for example the gripping elements can be flat 180° apart or they can be twisted as shown in FIG. **6** to form a three-dimensional structure. Twisting can be uniform or irregular or in either direction or alternately right handed and left handed depending on the use for the gripping elements. Gripping elements of this general type formed without a distinct separate head are shown in my U.S. Pat. No. 3,522,632.

FIG. **7** illustrates a suitable arrangement for carrying out the method of the present invention wherein a molten material such as glass or plastic **54** is caused to flow over a right angle surface **70.** Shafts **10** are attached to a moving member **72** which causes the ends of the shafts **10** to contact the molten material **54** for a period of time to form a head member **12** thereon. Withdrawing the shaft and head therefrom forms the gripping elements **20.**

In carrying out the method illustrated in FIG. **7,** several factors enter into shaping the head elements. Among these are:

1. viscosity of the molten material **54;**
2. contact time of the shafts **10** with the molten material **54;**

3. rate and direction with which the shafts **10** are withdrawn from the molten material **54** with a head attached thereto;
4. cooling rate of the molten material **54**;
5. post-heating and/or allowing gravity force to come into play; and
6. post-forming using mechanical forces such as a gas jet, centrifugal force, or electrical, electrostatic or magnetic attraction or repulsion forces.

Regulation of these factors will govern the shape of he head formed. For example, the arrangement shown n FIG. **7** is particularly suited for forming the gripping lements of FIG. **1***d*. Other post-treating or forming teps include pulling or rubbing the head against a surace and pressing or shaping the head from the top or ides.

It should also be understood that the head elements 10 may be molded or formed using conventional glass, lastic or metal fabricating techniques directly on the nd of a shaft **10** or separately followed by attachment o the shaft **10.**

This attachment may be accomplished using interocking mechanical force, adhesives, or heat seals and he like. As noted previously, the shaft **10** preferably as an external profile which promotes firm interlocking between the head **12** and the shafts **10.**

The upright shaft used in the present invention is provided with sufficient stiffness and toughness to resist deflection without breaking which would otherwise prevent the gripping element from entering and penetrating the receiving surface. Stated another way, the shafts **10** have sufficient tensile and impact strength and a modulus of elasticity such that the shaft maintains its upright position when the forces which are used to cause the self-gripping device to connect with the receiving surface are applied thereto. These strengths also play a vital role in maintaining the integrity of the connection between the self-gripping device and the receiving surface when mechanical forces are applied thereto.

The shafts **10** can be formed from glass or plastic but preferably from any metal or alloy that possesses the characteristics outlined above. Suitable metals and alloys include iron, steel, aluminum, brass, copper, alloys containing the foregoing and the like.

The head elements are generally made from glass, metal or plastic which has the hardness and mass characteristics required for the composite gripping element of the invention. Suitable plastics include both thermosetting and thermoplastic materials, as long as they are sufficiently hard and dense. Examples of such plastics include polyacetals, nylons, polyesters, polyimides, melamine, polycarbonates, polysulfones, polyphenylene oxides, urethane polymers, olefin polymers and the like.

The composite gripping elements are stiffly mounted in an upright fashion on a base. The phrase "stiffly mounted" is intended to mean that the gripping elements resist deflection which would otherwise prevent them from entering and becoming lodged in a receiving surface. Thus, the base can be flexible (e.g. a rubber sheet or strip) and the gripping elements interconnected with one another as illustrated in FIG. **3** to provide necessary stiffness. The base can also be stiff or rigid and the gripping elements stiffly attached thereto.

The base can be made of any suitable rigid, semirigid, stiff or flexible material such as paper, fabric, rubber, wood, plastic, metal, glass and the like. The shafts of the gripping elements can be an integral part of the base or can be stiffly attached thereto by suitable techniques such as mechanical penetration or by using adhesive, welding or similar techniques. Also the shafts can be inserted from the back or bottom of a base and held in place by a stop **24** such as is shown in FIG. **3** and disclosed in my U.S. Pat. No. 3,494,006, which is incorporated herein by reference.

The composite gripping elements can be of any size depending upon the nature of the receiving surface and the use to which the self-gripping device is to be put. Generally, the shafts have a diameter of from about 0.001 to about 0.08 inch and they should be long enough to penetrate into a receiving member a sufficient distance for the head element to become lodged therein.

The receiving layer for a member can be made of any material which is sufficiently soft or porous to permit the gripping elements to penetrate or lodge or become retained thereby. The thickness of the receiving member depends upon the nature and size of the composite gripping elements. Suitable receiving materials include woven and non-woven fabrics, felts, fibrous mats, metal or plastic mesh in one or more layers, foamed plastics, wood, and other suitable materials which may be woven, knitted, tufted, spun including carpet and carpet-like materials. Suitable receiving materials may be fabricated from paper, cardboard, steel wool, glass wool, perforated or expanded metal, or plastic sheet, corrugated paper and cardboard, thin metal and plastic foils such as aluminum foil and the like.

The self-gripping device, including the composite gripping elements, has multiple uses. It may be used to mount or attach virtually any type of decorative or functional member to any other member having a suitable receiving member thereon. For example, the self-gripping device can be attached to cladding elements such as tiles, placques, wall panels, wallpaper and cloth and the like to attach same to any element or member having a suitable receiving member thereon.

In a preferred embodiment the radius or degree of curvature of the upper penetrating portion of the head element is less than the radius or degree of curvature of the lower portion of the head. This is illustrated by FIG. **1***a*. Other head shapes having this character include tear, ovoid, eliptical, parabolic and cuneiform.

What is claimed is:

1. Self-gripping device comprising a multiplicity of composite gripping elements attached in an upright fashion to a base member, each of said composite gripping elements comprising an upright shaft having tensile and impact strengths and a modulus of elasticity such that it substantially retains its upright position when shearing, tensile or compressive forces are applied thereto, said shaft having permanently attached at its upper end a distinct and separate head element made of a different material than said shaft, said head element comprising a barb extending from said upper end downwardly toward said base member at a generally acute angle to said shaft and having a penetrating and gripping shape which describes at least one outer cone when rotated about the vertical axis of said shaft and which is adapted to enter and become lodged in a receiving surface, said head being further characterized as having a degree of hardness and a mass so as to facilitate penetration into a receiving surface upon connection therewith.

2. Self-gripping device of claim 1 wherein said shaft is metallic.

3. Self-gripping device of claim 1 wherein said composite gripping elements are attached to both sides of said base member.

4. Self-gripping device of claim 1 wherein said head is formed from glass.

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