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Lemelson et al.

[11] **3,927,881**

[45] **Dec. 23, 1975**

[54] **INTEGRALLY FORMED PROJECTILE AND HOOK-LIKE FASTENERS**

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[21] Appl. No.: **471,760**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 436,045, Jan. 24, 1974, Pat. No. 3,857,566.

[52] **U.S. Cl.**..... **273/58 K;** 46/DIG. 1; 273/106 R

[51] **Int. Cl.**[2]..... **A63B 71/02**

[58] **Field of Search**.... 46/DIG. 1; 273/106 R, 65 R, 273/65 E, 65 ED, 65 EE, 58 R, 58 B, 95 R, 102 B, 65 EG; 272/57 D

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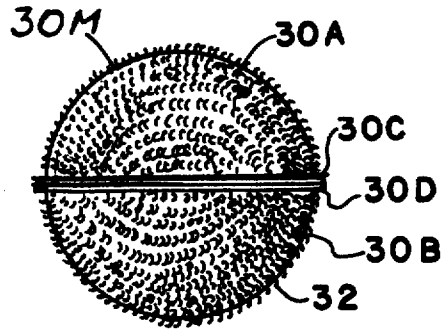
Primary Examiner—Richard J. Apley
Assistant Examiner—Marvin Siskind

[57] **ABSTRACT**

Constructions are provided in missiles for use in target games employing so called hooking materials or the like to retain the missiles against the targets. In one form, the missile is in the shape of a lightweight hollow ball, the outer surface of which is substantially entirely covered with a hook or broken loop filamentary material provided in a plurality of sheet-like formations thereof. In another form, the missile is formed of a molding having filamentary hook- or loop-like formations integrally molded as part of the missile base. In yet another form, the missile is formed of a lightweight plastic and hook-like formations of filamentary material are propelled against an adhesive coating the missile or a molten portion of the surface stratum thereof and are embedded therein across substantially the entire surface of the missile.

3 Claims, 10 Drawing Figures



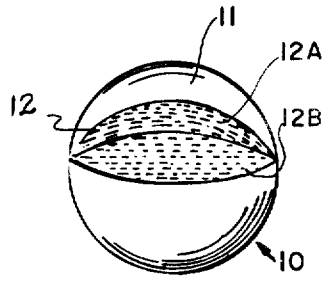


FIG. 1

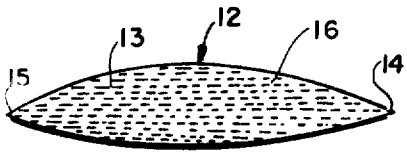


FIG. 2

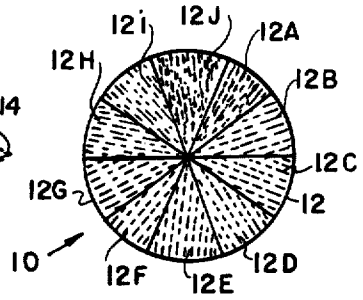


FIG. 3

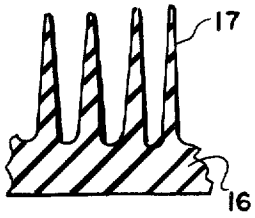


FIG. 4

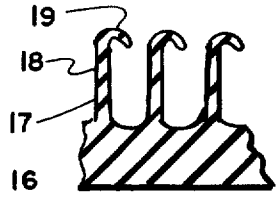


FIG. 5

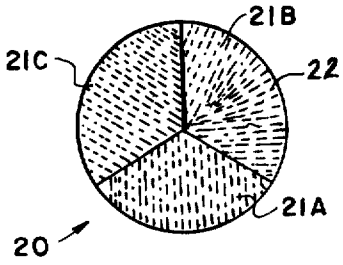


FIG. 7

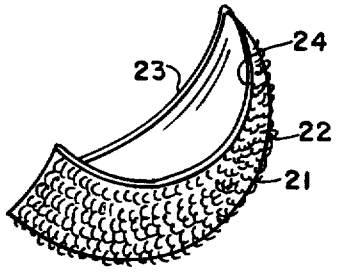


FIG. 6

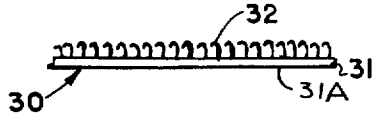


FIG. 8

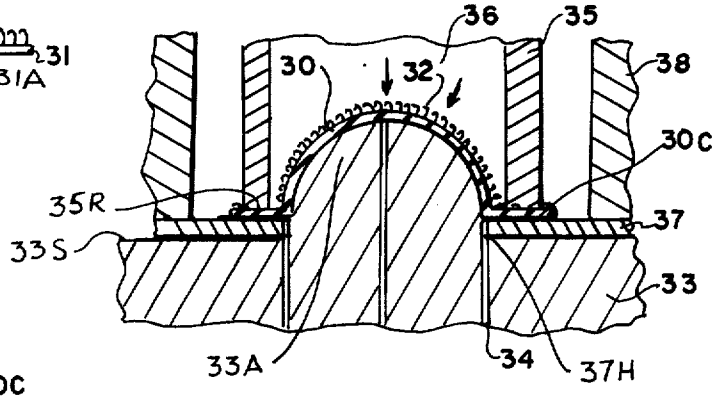


FIG. 9

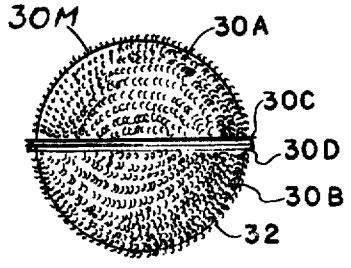


FIG. 10

INTEGRALLY FORMED PROJECTILE AND HOOK-LIKE FASTENERS

RELATED APPLICATIONS

This is a continuation-in-part of application Ser. No. 436,045 now U.S. Pat. No. 3,857,566 filed Jan. 24, 1974, and entitled Target Game.

SUMMARY OF THE INVENTION

This invention relates to new and improved structures in missiles particularly for use in safety type target games employing targets constructed of pile materials defined by a multitude of fine, filamentary hook-like formations across the surface thereof.

It is known in the art to provide target games formed of so called hooking textile materials which form a part of a target and a missile. Typical configurations and arrangements are illustrated in U.S. Pat. No. 3,032,345 which employs fastening material known as Velcro made by the American Velcro Corporation, New York, N.Y. Said U.S. Pat. No. 3,032,345 defines in FIG. 5 thereof a ball-shaped missile having its outer surface covered in part by a plurality of circular patches of hooking material. It has been found that such a missile employing spaced-apart patches of the fastening broken loop or hooking material suffers a shortcoming in that, if the portions of the ball or sphere which do not contain the hooking material should engage the target, there is a possibility that the missile will not be retained against the target or at least that portion of the target which the ball strikes.

The instant invention employs structures in missiles of the type defined in the U.S. Pat. No. 3,032,345, particularly ball or spherically shaped missiles and has, as a primary object the improvement in that substantially the entire exterior surface of the ball or missile is covered with tiny, filamentary hook-like formations which serve to retain the missile against the target regardless of which portion thereof strikes the target. While the hook-like formations covering the missile may be provided as suitably shaped patches of hooking material, as set forth hereafter, they may also comprise a multitude of tiny filamentary hooks which are electrostatically shot into an adhesive or a molten portion of the surface of the missile, or are integrally molded of the material of the missile's surface stratum.

Accordingly, it is a primary object of this invention to provide new and improved structures in safety darts and missiles for use in target games.

Another object is to provide a safety dart in the form of a spherically shaped member, having its outer surface substantially entirely covered with filamentary, hook-like formations to permit the missile to be retained against a target regardless of the portion thereof which strikes the target.

Another object is to provide a missile for use in hooking material target games which is light enough in weight such that it will not easily bounce off and detach itself from a hooking material target.

Another object is to provide improved methods for producing missiles for use in safety target games.

With the above and such other objects in view as may hereafter more fully appear, the invention consists of the novel constructions, combinations and arrangements of parts as will be more fully described and illustrated in the accompanying drawings, but it is to be understood that changes, variations and modifications

may be resorted to which fall within the scope of the invention as claimed.

In the drawings:

FIG. 1 is a side view of a hollow, lightweight plastic ball forming a portion of one embodiment of the invention;

FIG. 2 is a plan view of a portion of sheet-like hooking material forming one of a plurality of similarly shaped patches of said hooking material which may be bonded in edgewise abutment to the surface of the ball of FIG. 1;

FIG. 3 is an end view of the ball of FIG. 1 covered with a plurality of patches of hooking material of the type illustrated in FIG. 2; FIG. 4 is a cross-sectional view of a portion of a missile showing the wall structure thereof as having a plurality of spiny, filamentary formations integrally molded therein and protruding outwardly therefrom;

FIG. 5 is a cross-sectional view of a portion of a missile wall having filamentary hook-shaped formations integrally molded with and protruding outwardly from the outer surface of the wall;

FIG. 6 is an isometric view of a portion of a spherically shaped target;

FIG. 7 is an end view of three of the missile portions illustrated in FIG. 2 forming a ball or sphere thereof;

FIG. 8 is an edgewise view of a modified form of plastic sheet material having a plurality of rows of hook-like formations molded integral therein;

FIG. 9 is an end view with parts broken away for clarity of a molding apparatus for forming the sheet material of FIG. 8 into a semi-spherical shell-like member, two of which members may be edge bonded or sealed together to form a ball thereof, and

FIG. 10 is a side view of a ball shaped missile made of two parts molded by apparatus of the type shown in FIG. 9.

In FIG. 1 is shown a partially assembled missile **10** for use in target games and the like and composed of a lightweight spherical shell **11** in the form of a plastic molding such as a ping pong ball or other suitably formed ball having a plurality of sections **12** of sheet-like fastening material such as the previously described Velcro material which may be provided in a number of different forms, including a testile-like material which is die-cutable to shape such as the shape illustrated in FIG. 2. Two sections **12A** and **12B** of such material are illustrated as bonded adjacent to each other against the surface of the spherical ball **11** by means of a suitable adhesive. In one form of the invention, the fastening material may be configured as illustrated in FIG. 2 wherein ten such configurations denoted **12A–12J** are disposed in edgewise abutment with each other and bonded to conform to the entire surface of the hollow sphere **11** as illustrated in FIG. 3.

The section **12** illustrated in FIG. 2 contains a central portion **16** having curved side edges which taper at both ends towards apeces **14** and **15**. Such a configuration of relatively stiff Velcro material may be easily made to conform to the surface of the ball **11** without warping or wrinkling and, together with the suitable number of additional similarly shaped pieces, may be made to totally cover the sphere or ball to provide a substantially spherically shaped missile which will be easily retained against a target composed, for example, of pile textile material as defined in U.S. Pat. No. 3.032,345 and having a surface defined by a multitude of tiny filamentary hook-like formations for engaging

the hooks or loops protruding outwardly from the surfaces of the patches **12** of fastening material.

In FIG. **4** is shown details of a configuration of the wall structure of a modified form of missile which is composed of a sheet-like shell portion **16** having integrally molded therewith and protruding outwardly therefrom a plurality of spiny formations **17**, preferably of filamentary dimensions and varying from a few thousandths of an inch in diameter to between 0.020" and 0.030" in diameter. In FIG. **5**, the relatively straight filamentary formations **17** have their upper shank portions **18** thermally deformed or molded to provide the ends **19** thereof in hook-like configurations to permit the article or missile defined by such material to engage in hooking assembly with the described pile material composed of fine filamentary hook or loop-like formations extending across its surface.

The surface configuration illustrated in FIG. **5** may be employed in an injection or compression molding forming part of the missile wherein the hook-like formations **19** are integrally molded with the body of the missile and protrude outwardly therefrom to retain the missile against a material such as a brushed polyamide pile having its surface defined by a multitude of broken loops or hooks. In FIG. **6**, the molding **21** is in the shape of one-third of a sphere and is configured such that, when it is assembled with two similarly shaped configurations, the three will form a spherical shell having its outer surface formed with molded hooks of the type shown in FIG. **5**. Notations **23** and **24** in FIG. **6** refer to the opposite edges of the molding which abut with similarly configured edges of two similar moldings as illustrated in FIG. **7**, the three moldings being defined by the notations **21A, 21B** and **21C** and being adhesively or solvent bonded or welded together to form a spherically shaped missile thereof having integrally molded hook-like formations **22** protruding outwardly from substantially all of the spherical surface.

It is noted that the sphere **20** of FIG. **7** may be produced of semi-spherical moldings or moldings of any suitable configuration and number which may be assembled to form the spherically shaped missile.

In FIG. **8** is shown a thermoplastic sheet material **30** having a base portion **31** of substantially constant thickness and a multitude of tiny spine-like filamentary formations integrally secured or molded with the base sheet portion **31** and protruding outwardly therefrom. The construction illustrated in FIG. **8** may be similar to that shown in FIG. **5** wherein the base sheet formation and the filamentary hook formations are integrally molded of the same thermoplastic material which may comprise polyamides, high impact polystyrene, high density polyethylene, or other suitable so called engineering thermoplastic.

In FIG. **9** is shown an apparatus for forming part of a spherically shaped missile from two portions of the material **30** of FIG. **8**, each of which portions has been thermally deformed to the shape of the semi-spherical shell wherein two of such shells may be sealed together along their rims or flanges to form a spherically shaped missile **30M** as illustrated in FIG. **10**. The apparatus of FIG. **9** includes a lower die **33** having a protruding semi-spherical portion **33A** and provided with small holes **34** drilled therethrough to which vacuum pressure may be applied from a common planum (not shown). A section of the material **30** of FIG. **8** is disposed between the rim **35R** of a cylindrical member **35** defining a chamber **36** and a plate **37** having a hole **37H** for accommodating the portion **33A** of the die **33**. The sheet **30** is heat softened without substantially deforming the filamentary hook-like formations **32**, by applying heat to the flat surface of **30A** while held between the rim **35R** of cylindrical member **35** and plate **37** above the upper surface **33S** of die **33** after which member **35** and plate **37** are moved downwardly to the position illustrated in FIG. **9** while vacuum is applied to holes **34** and/or positive pressure is applied to chamber **36** so as to force and thermally deform the sheet, as shown in FIG. **9**, with the flat surface thereof made to conform to the spherical surface **33AS** of the die **33**. Two of the semi-spherical shells so formed, denoted **30A** and **30B** in FIG. **10**, are trimmed by die cutting close to the semi-spherical walls and the rims or flanges thereof, denoted **30C** and **30D**, are adhesively or solvent bonded or welded together to form a hollow, lightweight ball for use in target games as illustrated in FIG. **10**.

In molding the sheet material **30** of FIG. **8**, heat may be applied to the bottom surface **31A** of the sheet-like portion **31** to soften same while cool air or liquid may be applied to the upper surface containing the filamentary formations **32** to prevent destruction of the hook-shaped filamentary formations. The sheet **30** is immediately placed between members **35** and **37** and drawn or pressure formed over the semi-spherical portion **33A** of die **33**.

The fastening material **30** illustrated in FIG. **8** may also be formed by providing a sheet of thermoplastic material, rendering the upper stratum adjacent one surface thereof in a molten condition while maintaining the general configuration of the sheet and, while said surface stratum is in a molten condition, electrostatically injecting a multitude of small hook-like formations into the molten layer and solidifying the molten layer to integrally bond the hook-like formations thereto. The technique may be utilized to cover a sheet of thermoplastic material, a surface or sheet coated with thermoplastic material rendered temporarily molten to permit embedment of the straight ends of the hook-like filamentary formations therein or a molding composed of thermoplastic material, the outer surface of at least a portion of which is rendered molten by means of radiant heat energy applied thereto to permit same to receive electrostatically directed hook-like filamentary configurations and partially embed same within the molten outer layer.

What is claimed is:

1. A missile for use in dart games and the like, which dart games employ a target composed of a material having a surface defined by a multitude of tiny plastic hook-like formations adapted to releasably retain said missile thereagainst comprising:

a lightweight hollow body having a thin wall defining a convex outer surface configuration and forming a self-supporting bulbous enclosure of plastic,

a multitude of filamentary formations formed of the same plastic as that which comprises said hollow body and integrally molded with the wall of said hollow body,

said filamentary formations being cantilever supported by said hollow body and protruding outwardly from said wall of said hollow body with which they are molded,

each of said filamentary formations having a narrow shank which extends upwardly and outwardly from said hollow body with which said filamentary for-

mations are molded,

the outer ends of each of said filamentary formations being formed with a hook-like portion which extends laterally of the shank thereof and backwardly in the direction of said wall of said hollow body,

said filamentary formations defining a multitude of engaging elements for the hook-like formations of the target material,

said filamentary formations molded integrally with the wall of said missile being provided in sufficient number and distributed around the surface of said wall of said missile in a manner to retain said missile against the surface of said target containing said plastic hook-like formations which it is directed against regardless of which portion of said missile containing said filamentary formations strikes said target.

2. A missile in accordance with claim 1 wherein said hollow body is molded in the shape of a sphereoid.

3. A missile in accordance with claim 1 wherein said hollow body is formed of a plurality of separate shell-like sections each containing a multitude of said filamentary formations molded integral with and protruding from the outer surfaces thereof and each having peripheral edge portions which are joined together with the edge portions of the others to form said hollow body.

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