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(54) **MULTI-BRANCH JUNCTION OVERWRAP**

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(51) **Int. Cl.**
H02G 3/00 (2006.01)

(52) **U.S. Cl.** ..... **174/72 R**; 174/117 F; 174/92; 138/121

(58) **Field of Classification Search** ..... 174/72 R, 174/92, 74 A, 117 F, 93, 71 R, 36, 68.1, 68.3; 138/121, 166; 285/156
See application file for complete search history.

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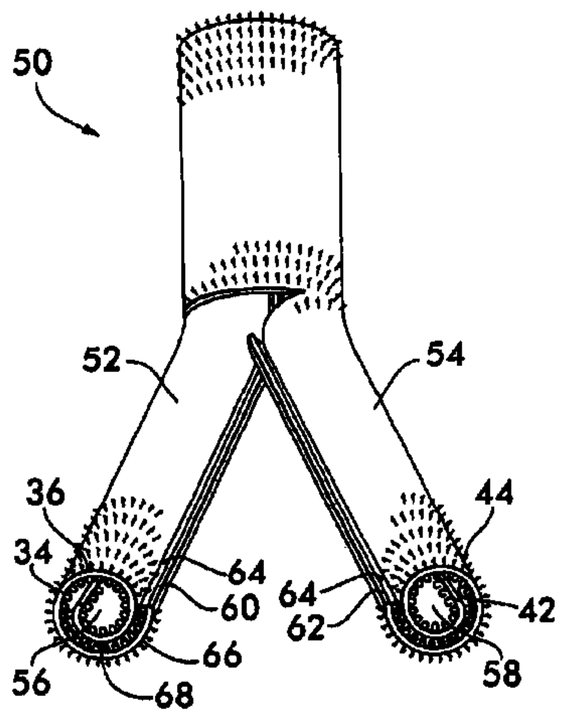
(57) **ABSTRACT**

A multi-branch overwrap for protecting elongated items is disclosed. The overwrap is formed from a flexible, resilient substrate. Interengageable attachments are positioned on opposite sides of the substrate for releasably attaching one surface of the substrate to the other. The substrate may be biased to form a plurality of interconnected tubes or reverse folded to form channels that receive the elongated items. Biasing or folding brings the opposite sides of the substrate into overlapping relation. The overwrap may be formed from a unitary blank or assembled from component parts. Preferred materials for the substrate include polyester felt, and preferred attachments include hook and loop fasteners distributed on the surface of the substrate.

22 Claims, 6 Drawing Sheets



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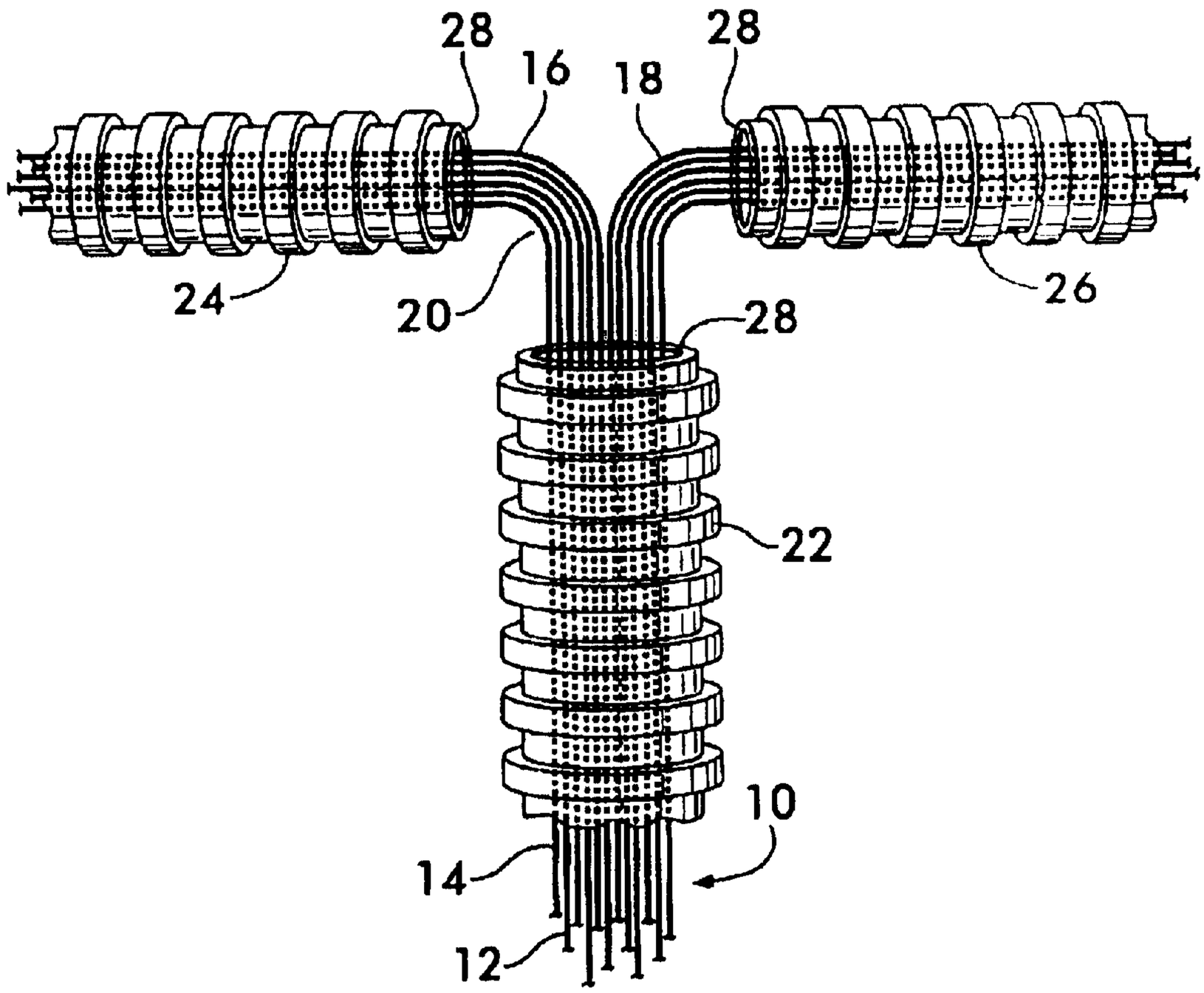


FIG.1
(PRIOR ART)

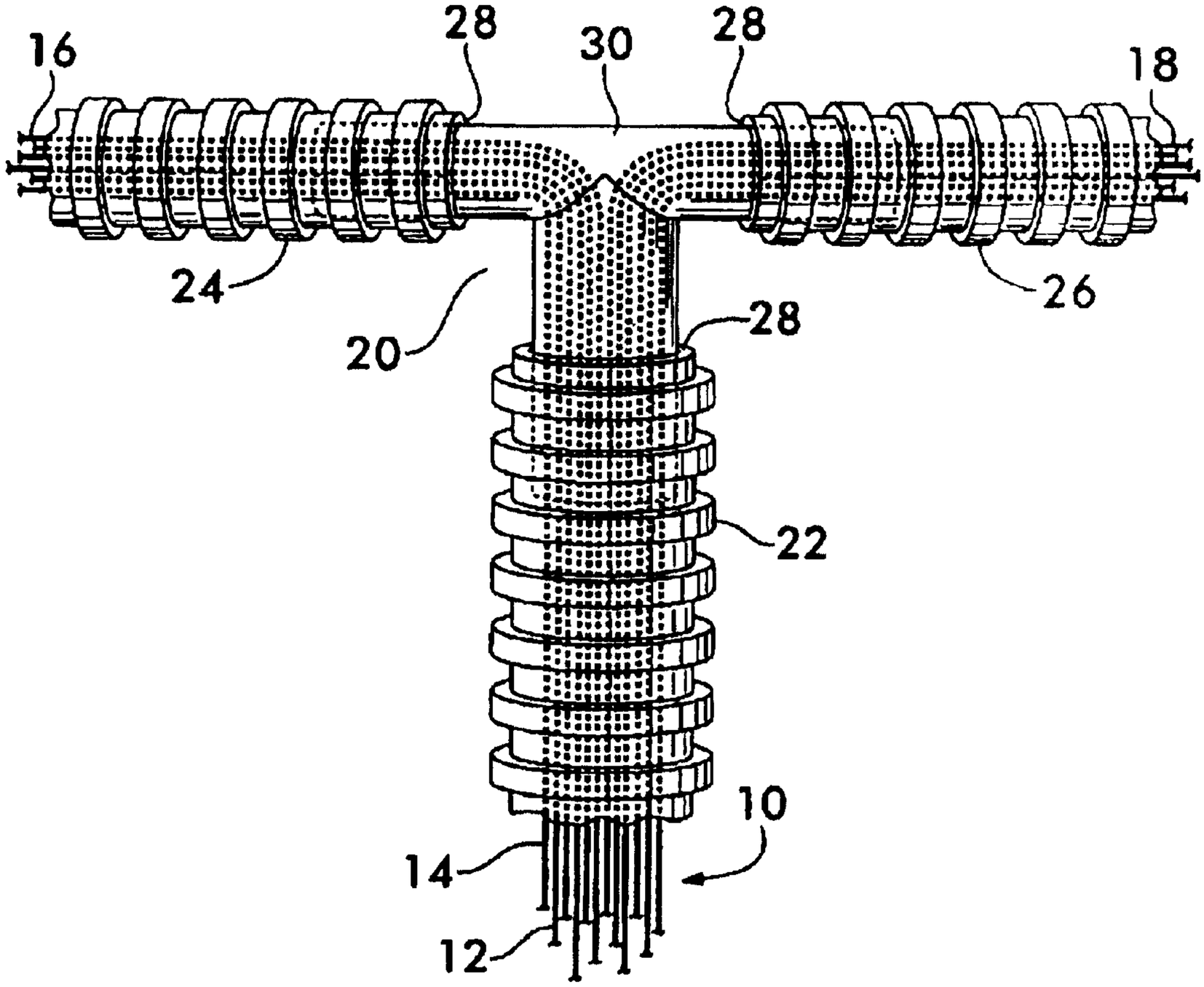


FIG.2

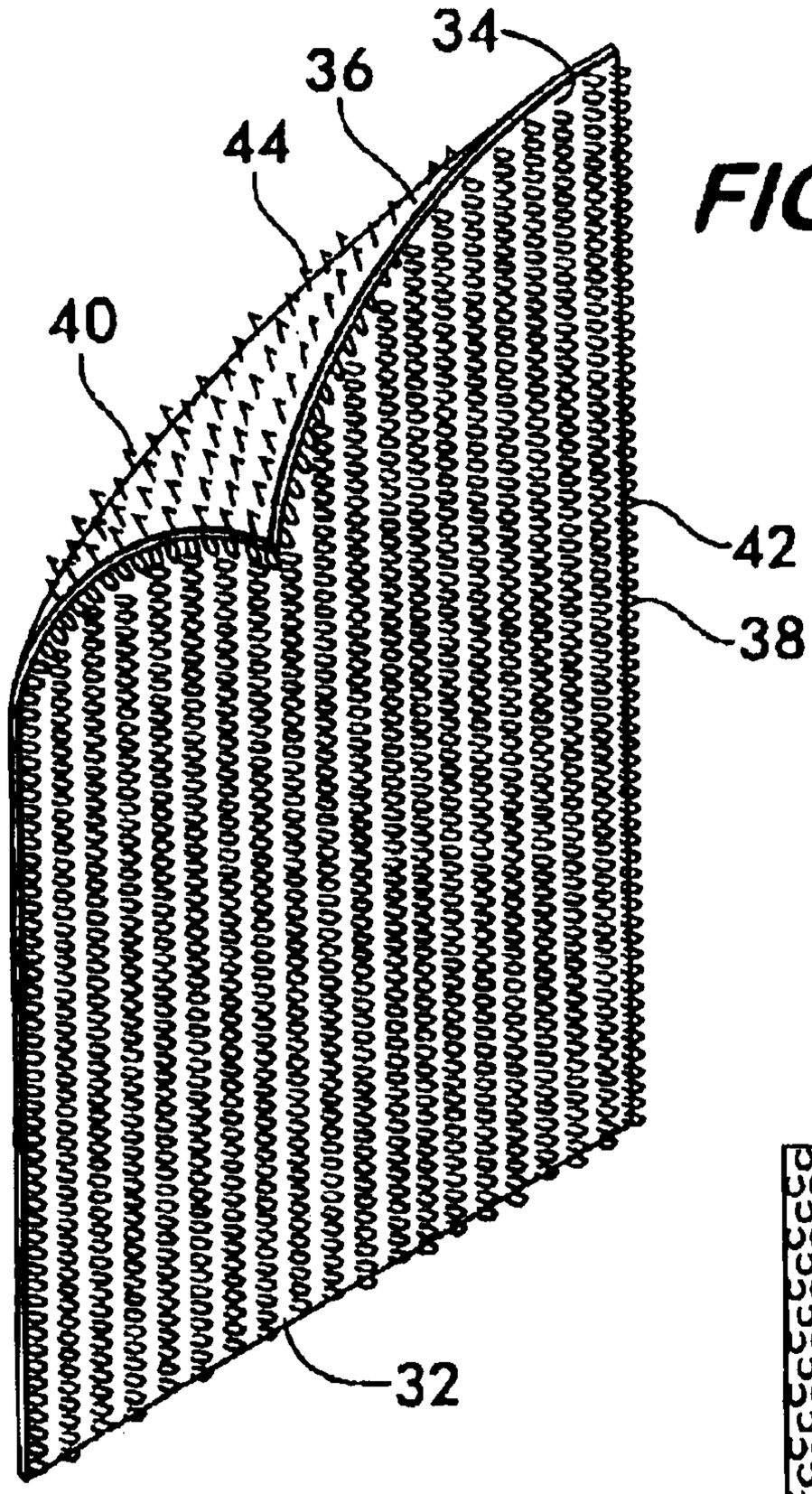


FIG.3

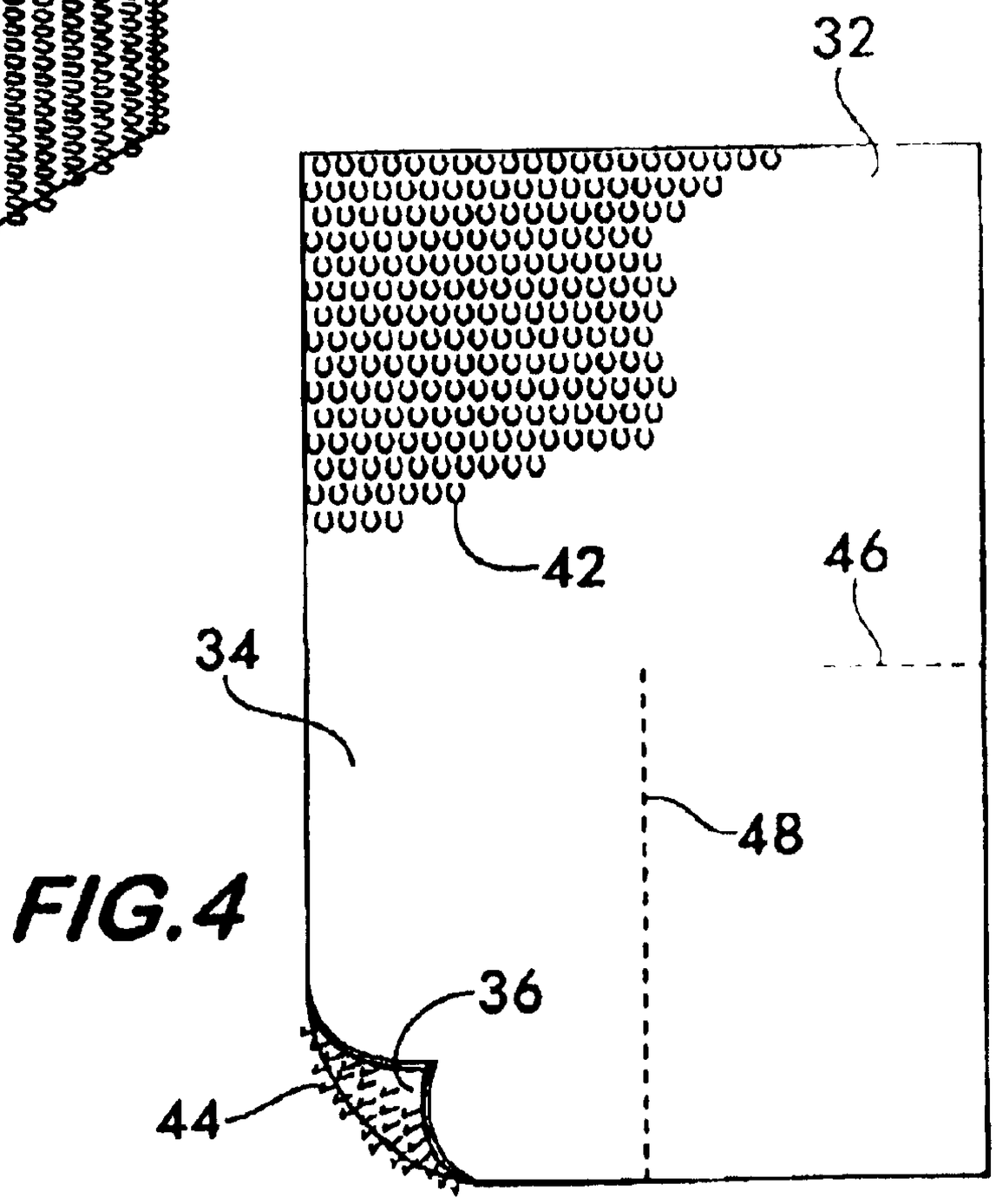


FIG.4

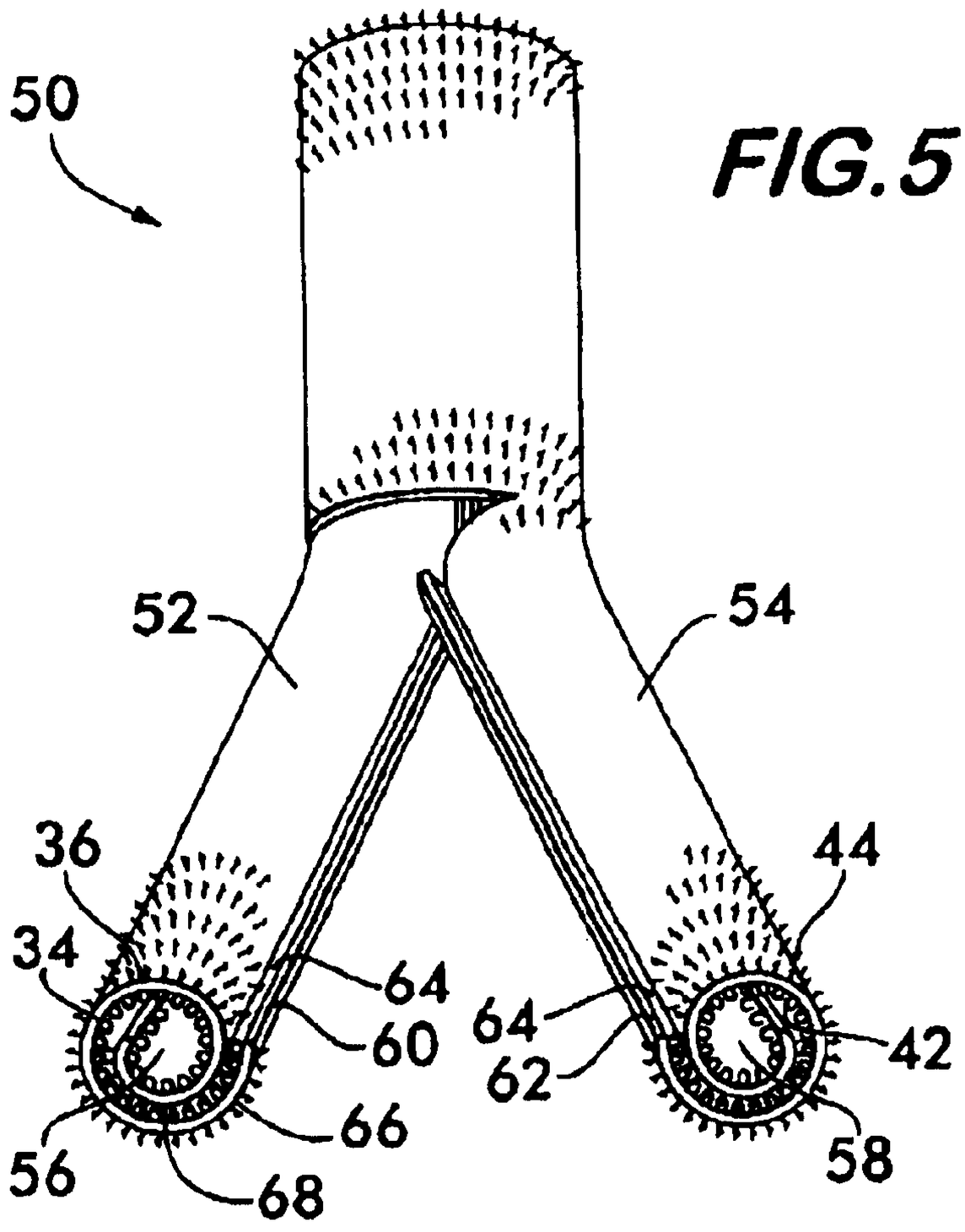


FIG. 5

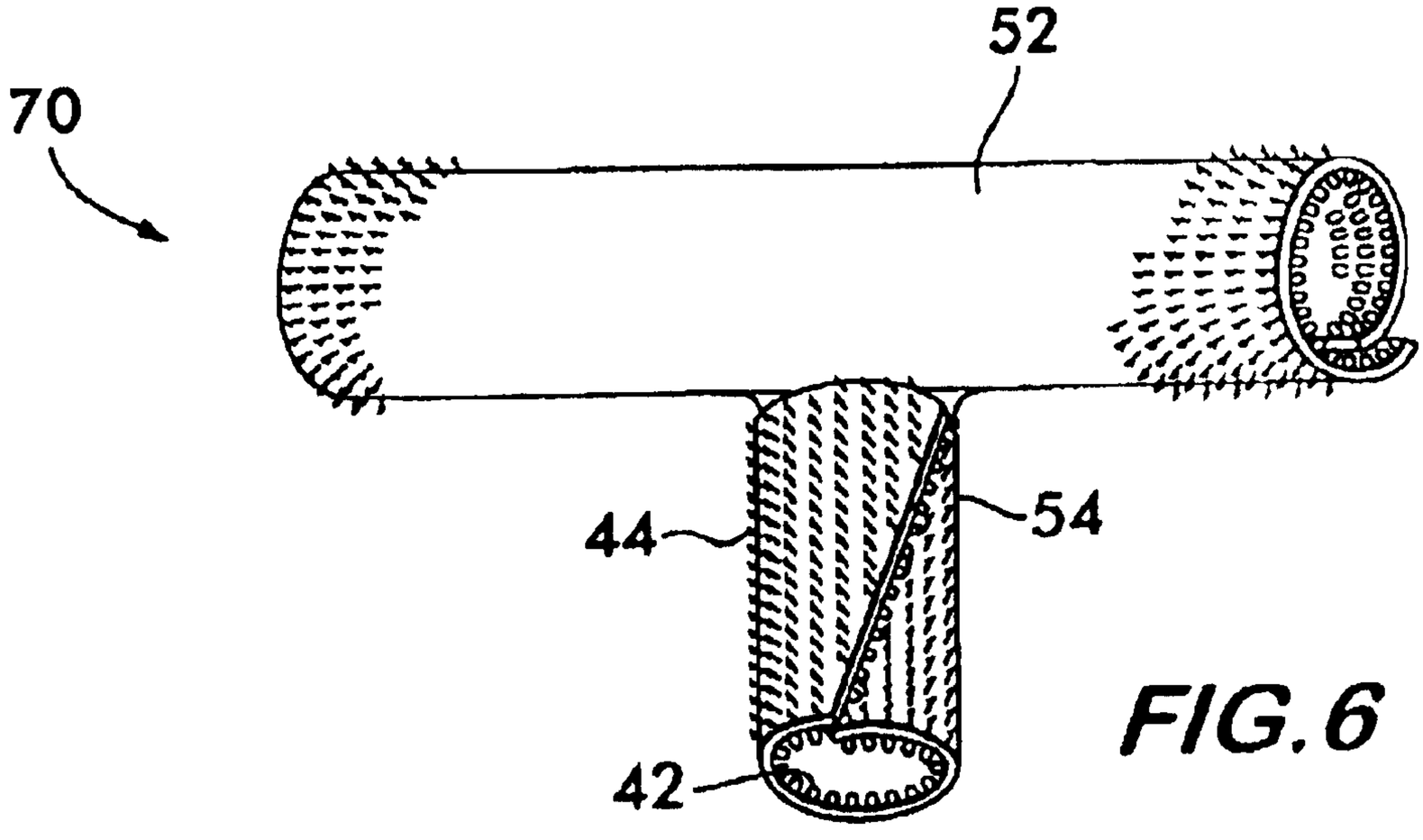
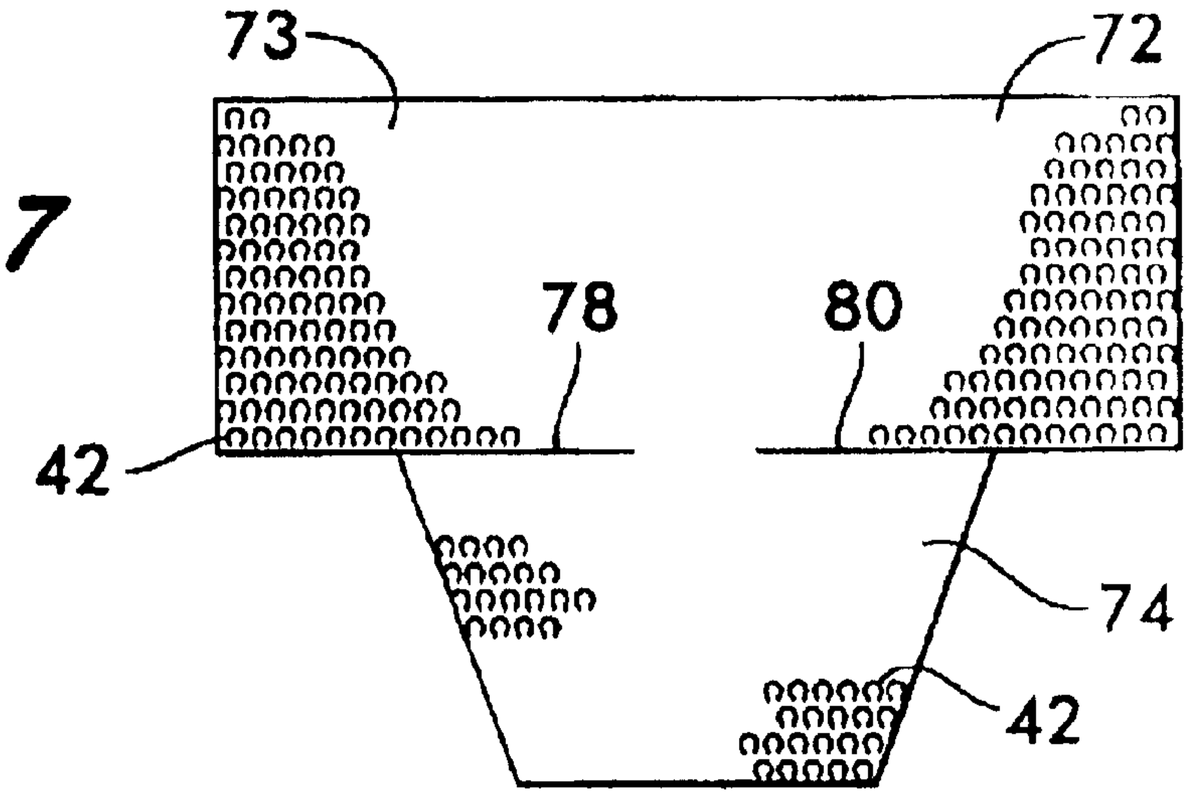


FIG. 6

FIG. 7



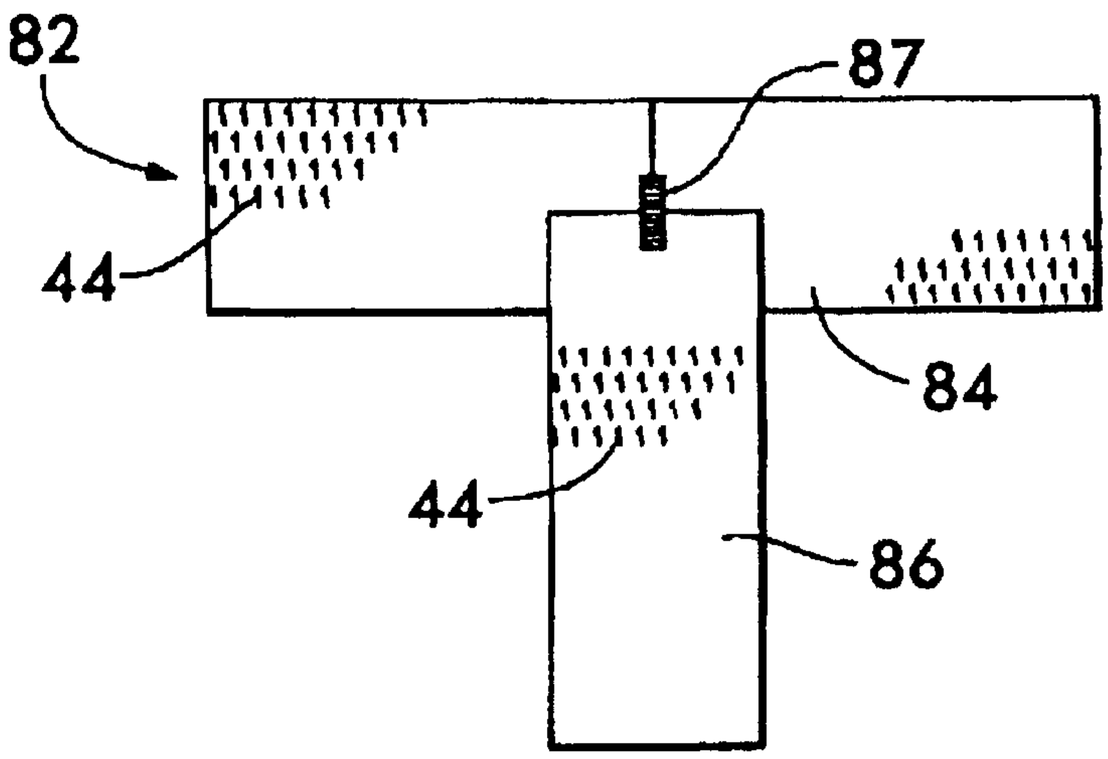


FIG. 8

FIG. 9

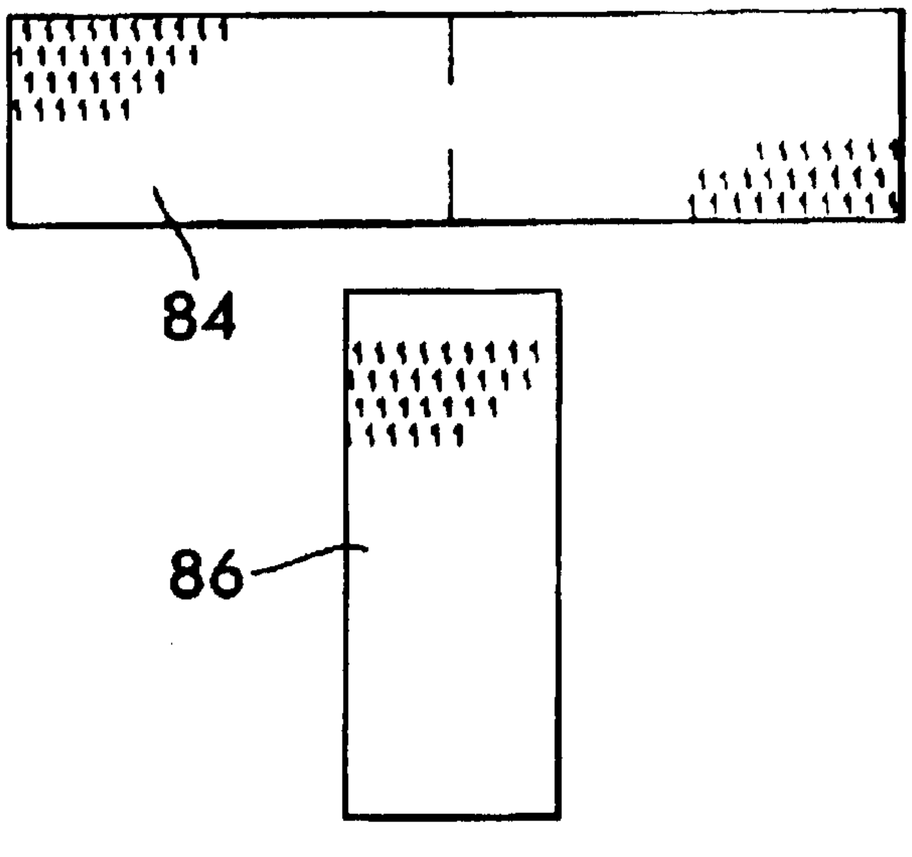
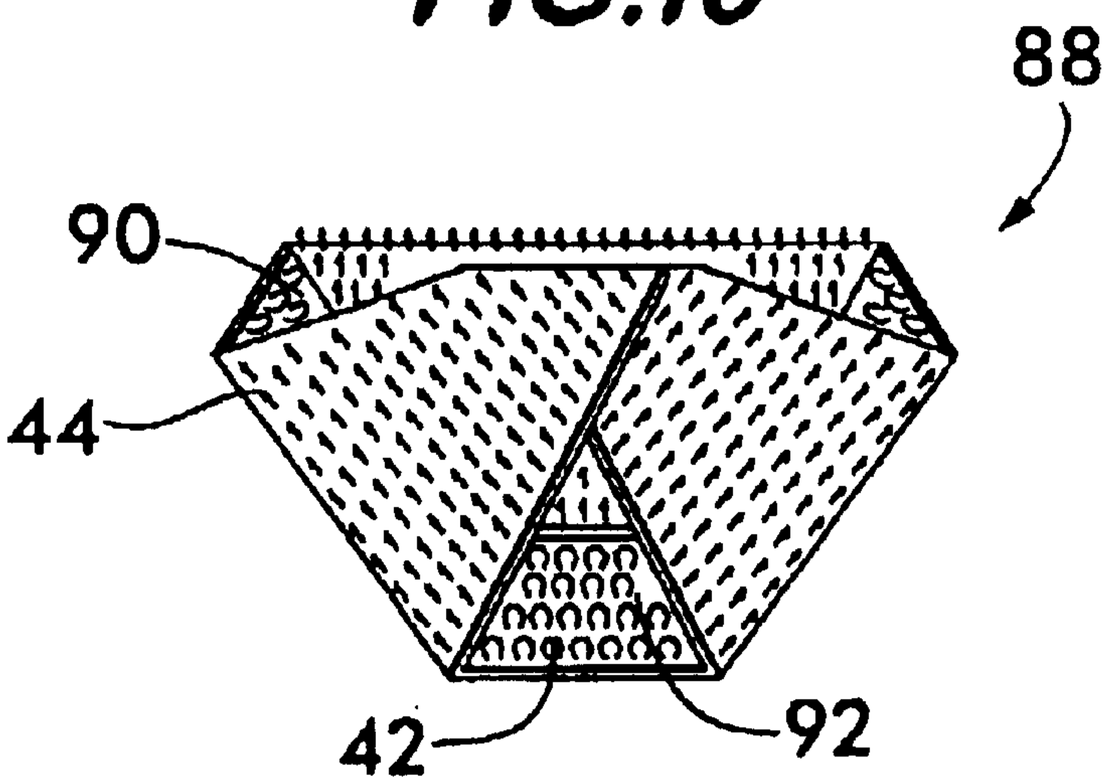


FIG.10



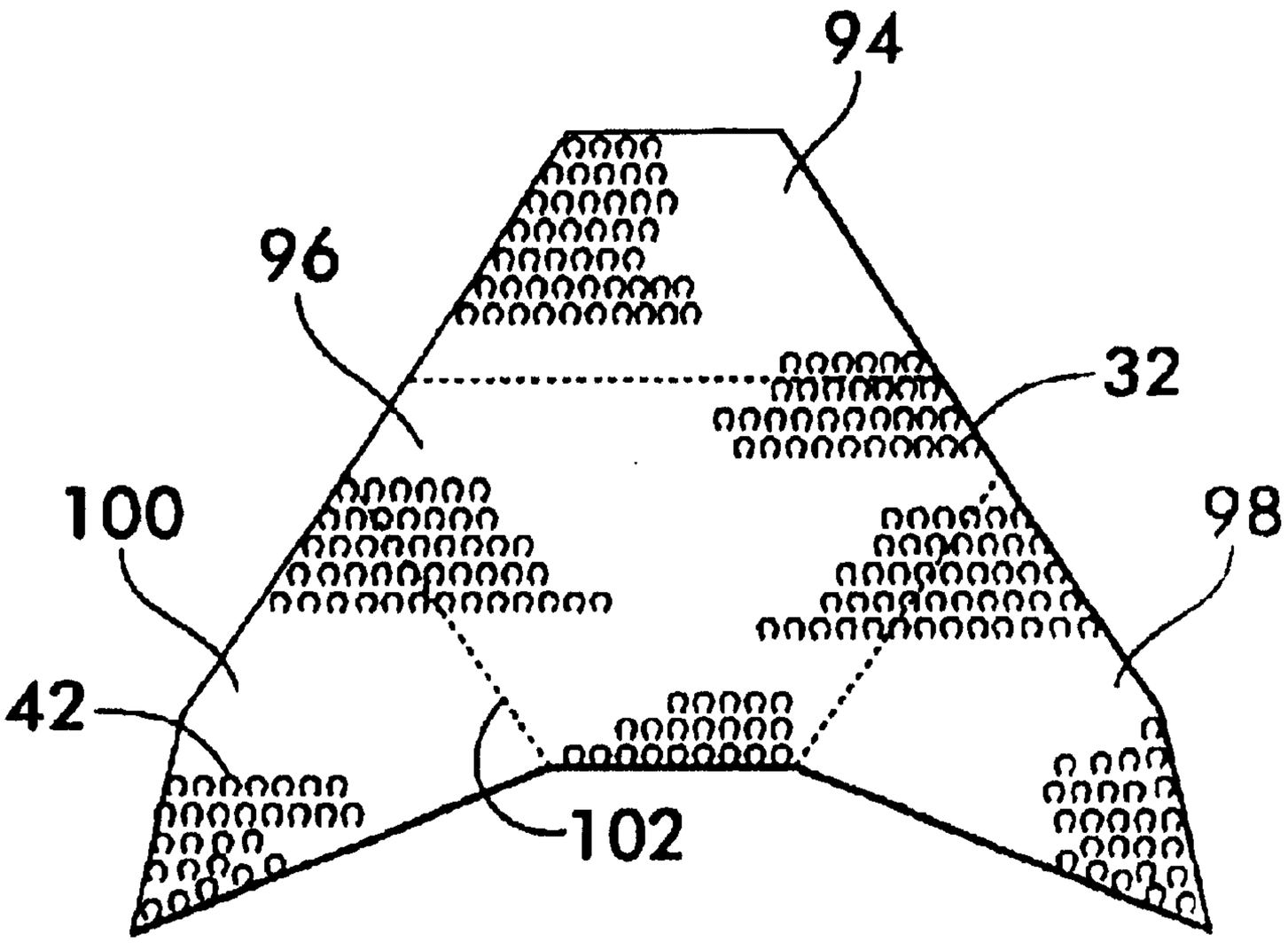


FIG.11

MULTI-BRANCH JUNCTION OVERWRAP

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This application claims the benefit of U.S. Provisional Application No. 60/451,819 filed Mar. 4, 2003.

FIELD OF THE INVENTION

This invention concerns pre-shaped covers positionable at junctions where two or more branches of elongated items are joined to another branch for protecting the elongated items against damage due to cuts, chafing and abrasion.

BACKGROUND OF THE INVENTION

Elongated items such as wiring harnesses used in automotive, marine and aerospace applications are preferably ensheathed in a protective covering which extends along the length of their run. The covering may be, for example, flexible convolute tubing formed of a polymeric material. Such tubes have sufficient stiffness to hold the various wires comprising the harness in an organized bundle and thus provide for a neat installation. The tubes are also sufficiently flexible to conform to curved paths which the harness may be forced to take when routed through an automotive or aircraft structure. The tubes provide a tough, abrasion resistant exterior which protects the wires of the wiring harness from damage which would otherwise occur when the harness rubs against structure in response to vibration.

However, at branch points in the wiring harness where two or more branches of the harness separate from another branch to follow different paths, the convolute tubing is present on each branch but stops short of the actual junction. This leaves a length of each branch at or near the junction exposed to damage by cuts and abrasion. In fact, the protective tubing itself can be a source of abrasion damage because the harness can chafe against the sharp edge of the convolute tubing formed at the tube end where it was cut to accommodate the branching of the harness.

This problem is often addressed by wrapping the wiring harness at the junction with flexible, self-adhesive tape, for example, vinyl electrical tape. While this solution provides some degree of protection to the harness at the junction, it suffers the following disadvantages. The tape stiffens the harness at the junction, making it less accommodating to the path it must assume. The tape is never applied, in practice, in a standard or uniform manner, resulting in some junctions having too much tape and some too little. Furthermore, the tape requires considerable time to install, and once installed, the tape, due to its adhesive nature, prevents ready access to the harness for repairs or splices. To effect a repair or a splice, the tape must be laboriously removed by hand each time the junction is serviced. The tape is usually applied over both the harness and the convolute tubing and does not provide any protection against chafing of the harness wires by the sharp edge at the end of the tube. Clearly, there is a need for an article which protects wiring harness junctions which eliminates the use of adhesive tape and its many disadvantages.

SUMMARY OF THE INVENTION

The invention concerns an overwrap for protecting elongated items. The overwrap comprises a flexible substrate having first and second surfaces oppositely disposed. A first attachment means is positioned on the first surface and extends substantially thereover. A second attachment means is positioned on the second surface and extends substantially thereover. The second attachment means is engageable with the first attachment means for removably attaching the first and second surfaces to one another when the first surface is brought into contact with the second surface.

Preferably, the first attachment means comprises a multiplicity of hooks extending from the first surface and the second attachment means comprises a multiplicity of loops extending from the second surface.

The substrate may be resiliently biased so as to form a tube wherein a portion of the first surface overlies a portion of the second surface. The tube has a central space for receiving the elongated items, the first and second surface portions being engageable with one another to affix the tube around the elongated items.

The tube may comprise a first tubular segment defining a first central space and a second tubular segment defining a second central space. The first and second tubular segments are connected to one another with the first and second central spaces in communication with one another.

In an alternate embodiment, the overwrap comprises a first substrate portion that is turned back upon a remainder of the substrate to form a reverse fold. The reverse fold defines a channel between the first substrate portion and the remainder for receiving the elongated items. A second substrate portion is turned back upon the remainder of the substrate into overlapping relation with the first substrate portion. The first attachment means on one of the first and second substrate portions engages the second attachment means on the other of the first and second substrate portions to hold the first and second substrate portions in overlapping relation to secure the reverse fold defining the channel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of a wiring harness junction showing various branches protected by convolute tubing;

FIG. **2** is a plan view of the wiring harness of FIG. **1** wherein a multi-branch junction overwrap is installed to protect the junction;

FIG. **3** is a perspective view of a substrate used to form the overwrap according to the invention;

FIG. **4** is a plan view of a substrate blank for forming an overwrap;

FIG. **5** is an embodiment of an overwrap according to the invention formed from the substrate blank shown in FIG. **4**;

FIG. **6** is a perspective view of another embodiment of an overwrap;

FIG. **7** is a plan view of a substrate blank for forming the overwrap shown in FIG. **6**;

FIG. **8** is a plan view of another embodiment of an overwrap;

FIG. **9** is an exploded view showing the components used to form the overwrap illustrated in FIG. **8**;

FIG. **10** is a plan view of another embodiment of an overwrap; and

FIG. **11** is a plan view of a substrate blank used to form the overwrap shown in FIG. **10**..

DETAILED DESCRIPTION OF THE EMBODIMENTS

FIG. **1** shows a wiring harness **10** formed of a bundle of wires **12**, the wires separating from a main branch **14** into

two branches **16** and **18** at a junction **20**. Each branch **14**, **16** and **18** is ensheathed by a protective covering, in this example, flexible convolute tubing **22**, **24** and **26**. The tubing extends substantially over the length of the various branches but does not cover the junction **20** where the wires are exposed to damage by cuts and abrasion. The edges **28** formed at or adjacent to junction **20** where tubes **22**, **24** and **26** have been cut to length are themselves a potential source of abrasion damage to wires **12**, which will rub against the edges **28** when subjected to vibration.

As shown in FIG. **2**, a multi-branch junction overwrap **30** according to the invention is positioned over the wiring harness **10** at junction **20**. Overwrap **30**, various embodiments of which are described in detail below, extends along each branch **14**, **16** and **18** from the junction **20** over a predetermined length of harness sufficient to be positioned coaxially within the tubes **22**, **24** and **26** so as to be between the edges **28** and the wires **12** to prevent chafing and abrasion of the wires by the tube edges.

Preferably, as shown in FIG. **3**, the overwrap **30** is formed from flexible resilient substrate **32** having good wear characteristics enabling it to withstand vibration induced abrasion. Substrate **32** has a first surface **34** and an oppositely disposed second surface **36**. The surfaces **34** and **36** have respective attachment means **38** and **40** that extend substantially over them. The attachment means **38** and **40** are compatible with one another in that they allow surface **34** to be removably attached to the surface **36** when the surfaces are brought into engagement. Such attachment means include, for example, loops **42** and hooks **44** distributed over the surfaces **34** and **36** respectively which allow the surfaces to be attached to and released from one another repeatedly.

It is advantageous that the substrate **32** comprise a non-woven material, preferably nylon felt. Nylon has excellent abrasion resistance and may be resiliently biased into a tubular shape, as described below, to provide a convenient form adapted to the elongated items such as wiring harness **10** which the overwrap **30** is to cover and protect. Nylon felt also has the advantage of providing the loops **42** to which the hooks **44** will attach without the need for the attachment of a separate component to the substrate. Other materials, such as polyester, polypropylene, polyethylene, polyethylene terepthalate and polytetrafluoroethylene are also feasible. Furthermore, substrate **32** may be a substantially continuous membrane or may also be woven or knitted from filamentary members.

Substrate **32** may be processed in various ways to yield a plurality of overwrap designs. As shown in FIG. **4**, substrate **32**, having a rectangular shape, is partially cut along dotted lines **46** and **48** and then resiliently biased into a tube. Biasing may be effected by heating the substrate and mechanically curving it into the tubular shape, as well as by chemical and cold-working means depending upon the substrate material. Once the substrate **32** is cut and biased into a tube, a particular overwrap embodiment **50**, shown in FIG. **5**, may be formed by separating tubular segments **52** and **54** from one another to yield a Y-shaped overwrap. Cuts **46** and **48** allow the tubular segments **52** and **54** to be conveniently defined from a unitary sheet of substrate **32**.

As illustrated in FIG. **5**, the tubular segments **52** and **54** of overwrap **50** each define a central space **56**, **58** that receives the elongated items. The central spaces **56** and **58** are in communication with one another to allow branches of the elongated items to join or break away from one another. Cut line **48** (see FIG. **4**) defines edges **60** and **62** that define slits **64** which provide openings for access to the central spaces **56** and **58**. Tubular segments **52** and **54** are biased so that a portion **66** of the first surface **34** overlies or overlaps a portion **68** of the second surface **36**. This overlying/overlapping relation between the surface portions allows the attachment means **38** and **40** (shown in FIG. **3**) on opposite surfaces **34** and **36** to engage one another and effect a releasable attachment between the surfaces, closing the openings **64**. Preferably, the biasing is such as to initially produce an extensive overlap of the portions **66** and **68**. This extensive overlap allows the overwrap **50** to be used on a wide range of elongated items having different diameters, the overwrap being easily adjustable to accommodate the various diameters. Note that for the tubular overwrap **50**, one or the other of the surfaces **34** and **36** will face outwardly, the other facing inwardly toward the central space. Which particular surface faces in which direction will depend upon the type of attachment means employed and the environment that the elongated items are expected to see. For example, it may be advantageous to position the surface having the loop attachment means facing inwardly so that the loops provide damping to the elongated items and do not accumulate foreign matter.

The overwrap according to the invention need not have a Y-shape. Tubular segments **52** and **54** may have any of various proportions or angular orientations relatively to one another. Depending upon the elongated items, a right or 90° orientation may be preferred as shown in embodiment **70** in FIG. **6**. FIG. **7** illustrates a unitary blank **72** from which overwrap **70** is formed. Blank **72** has a rectangular portion **73** and a trapezoidal portion **74**, the two portions being partially separated from one another by cuts **78** and **80**. The cuts so placed allow the rectangular portion **73** to form tubular segment **52** and the trapezoidal portion **74** to form tubular segment **54** when the blank **72** is biased.

FIG. **8** shows an overwrap **82** assembled from individual pieces of substrate **84** and **86**, illustrated in FIG. **9**. The substrate pieces have attachment means as illustrated in FIG. **3** and are preferably joined to one another by an ultrasonic weld **87**, but could also be sewn or adhesively bonded together.

As shown in FIG. **10**, an overwrap **88** according to the invention need not be tubular in shape but may comprise a plurality of channels **90** and **92** that receive the elongated items. Overwrap **88** is formed from a substrate **32**, shown in FIG. **11**, by first folding or turning a substrate portion **94** back upon a remainder **96** of the substrate to form the channel **90**, and then turning or folding one or more other substrate portions **98** and **100** into overlapping relation with the substrate portion **94** so that channel **92** is formed and one attachment means, for example, **42**, on one surface of substrate portions **98** and **100** engages the other attachment means **44** on an opposite surface of the substrate portion **94**. The attachment means holds the substrate **32** in the shape that defines channels **90** and **92** so that the overwrap **88** may receive, surround and protect elongated items at a junction.

Preferably, substrate **32** of FIG. **11** is cut into a desired shape that will fold conveniently and define the requisite channels. To further assist a technician in the use of the overwrap **88**, score lines **102** may be positioned on the substrate **32** to define the nature of the folds needed. The score lines **102** may be grooves cut partially through the substrate or may merely be printed lines on one or both substrate surfaces. Other indicia, indicative of the order for folding or defining the inner and outer surfaces of the channel, may also be printed on the substrate **32**.

Multi-branch overwraps according to the invention provide excellent damping and abrasion protection at junction

points of elongated items such as wiring harnesses. Such overwraps are especially versatile as to form, size and flexibility and readily accommodate elongated items of various sizes and angular orientations, the overwraps being especially effective when used in conjunction with other types of protective sleeving, such as convolute tubing.

What is claimed is:

1. An overwrap for protecting elongated items, said overwrap comprising:

a flexible substrate having first and second surfaces **[**oppositely disposed**]** *facing away from one another*, said substrate being resiliently biased so as to form a tube wherein a portion of said first surface overlies a portion of said second surface, said tube having a central space for receiving said elongate items;

a first attachment means positioned on said first surface and extending substantially thereover;

a second attachment means positioned on said second surface and extending substantially thereover, said second attachment means being engageable with said first attachment means for removably attaching said first and second surfaces to one another when said first surface is brought into contact with said second surface, said first and second surface portions being engageable with one another to affix said tube around said elongated items; and

wherein said tube comprises a first tubular segment defining a first central space and a second tubular segment defining a second central space, said first and second tubular segments being connected to one another with said first and second central spaces in communication with one another.

2. An overwrap according to claim **1**, wherein said first attachment means comprises a multiplicity of hooks extending from said first surface and said second attachment means comprises a multiplicity of loops extending from said second surface.

3. An overwrap according to claim **1**, wherein said substrate comprises a non-woven material.

4. An overwrap according to claim **1**, wherein said substrate comprises a nylon felt.

5. An overwrap according to claim **1**, wherein said first and said second tubular segments are oriented angularly with respect to one another.

6. An overwrap according to claim **1**, wherein said first tubular segment is oriented at approximately 90 **[**.quadrature.**]** degrees to said second tubular segment.

7. An overwrap according to claim **1**, wherein said tubes are comprised of a non-woven material.

8. An overwrap according to claim **1**, wherein said tubes are comprised of a nylon felt.

9. An overwrap for protecting elongated items, said overwrap comprising:

a flexible substrate having first and second surfaces oppositely disposed;

a first attachment means positioned on said first surface and extending substantially thereover;

a second attachment means positioned on said second surface and extending substantially thereover, said second attachment means being engageable with said first attachment means for removably attaching said first and second surfaces to one another when said first surface is brought into contact with said second surface;

a first substrate portion being turned back upon a remainder of said substrate to form a first reverse fold, said first reverse fold defining a first channel between said first substrate portion and said remainder for receiving said elongated items; and

a second substrate portion being turned back upon said remainder of said substrate into overlapping relation with said first substrate portion, said first attachment means on one of said first and second substrate portion engaging said second attachment means on the other of said first and second substrate portions to hold said first and second substrate portions in overlapping relation to secure said reverse fold defining said first channel;

a third substrate portion being turned back upon said remainder of said substrate to form a second reverse fold, said second reverse fold defining a second channel between said third substrate portion and said remainder, said third substrate portion being in overlapping relation with said second substrate portion, one of said first and second attachment means on said third substrate portion engaging the other of said first and second attachment means on said second substrate portion to secure said second reverse fold defining said second channel.

10. An overwrap according to claim **9**, further comprising a score line positioned on said substrate, said score line defining a boundary between said first substrate portion and said remainder of said substrate, said score line facilitating said reverse fold.

11. An overwrap according to claim **10**, wherein said score line is printed on one of said surfaces of said substrate.

12. An overwrap according to claim **10**, wherein said score line comprises a groove in one of said surfaces of said substrate.

13. An overwrap for protecting elongated items, said overwrap comprising:

a first tube defining a first central space for receiving said elongated items, said first tube having an inwardly facing surface and an outwardly facing surface oppositely disposed, a first slit being formed lengthwise along said first tube, said first slit forming a first opening providing access to said first central space;

a first attachment means positioned on said inwardly facing surface and extending substantially thereover, and a second attachment means positioned on said outwardly facing surface and extending substantially thereover, said first and second attachment means being removably engageable with one another by bringing said inwardly and outwardly facing surfaces of said first tube into overlapping relation along said first slit to close said first opening;

a second tube defining a second central space for receiving said elongated items, said second tube being attached to said first tube, said second central space being in communication with said first central space, said second tube having an inwardly facing surface and an outwardly facing surface oppositely disposed, a second slit being formed lengthwise along said second tube, said second slit forming a second opening providing access to said second central space; and

said first attachment means being positioned on said inwardly facing surface of said second tube and extending substantially thereover, said second attachment means being positioned on said outwardly facing surface of said second tube and extending substantially thereover, said first and second attachment means on said second tube being removably engageable with one another by bringing said inwardly and outwardly facing surfaces of said second tube into overlapping relation along said second slit to close said second opening.

14. An overwrap according to claim **13**, wherein said first attachment means comprises a multiplicity of hooks extending from said first surfaces and said second attachment means comprises a multiplicity of loops extending from said second surfaces.

15. An overwrap according to claim 1, wherein said first attachment means extends substantially over said first surface and said second attachment means extends substantially over said second surface.

16. An overwrap according to claim 1, wherein at least one of said first or second tubular segments is resiliently biased into its tubular form.

17. An overwrap for protecting elongated items, said overwrap comprising:

a unitary flexible substrate biased to form a tube having a central space for receiving said elongate items; and

wherein said tube comprises a first tubular segment defining a first central space and a second tubular segment defining a second central space, said first and second central spaces being joined in communication with one another at substantially 90 degrees to one another wherein said flexible substrate has first and second surfaces facing away from one another in oppositely disposed fashion, wherein a portion of said first surface overlies and engages a portion of said second surface to form said first and second tubular segments.

18. An overwrap according to claim 17, wherein said flexible substrate further comprises a first attachment means on said first surface and a second attachment means on said second surface, said second attachment means being engageable with said first attachment means for removably attaching said first and second surfaces to one another.

19. An overwrap according to claim 18, wherein said first attachment means comprises a multiplicity of hooks extending from said first surface and said second attachment means comprises a multiplicity of loops extending from said second surface.

20. An overwrap according to claim 17, wherein said flexible substrate is comprised of a non-woven material.

21. An overwrap according to claim 17, wherein said flexible substrate is comprised of a nylon felt.

22. An overwrap according to claim 17, wherein at least one of said first or second tubular segments is resiliently biased into its tubular form.

* * * * *