

[54] **METHOD AND APPARATUS FOR  
MAKING FLEXIBLE STRIPS OF  
MATERIAL HAVING A PILE OF HOOK-  
SHAPED ELEMENTS**

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[51] **Int. Cl.** .....B21d 53/52, B23p 13/04

[58] **Field of Search** .....29/410, 558, 557, 207.5

[56]

**References Cited**

**UNITED STATES PATENTS**

3,290,747 12/1966 Burbank .....29/410 X

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[57]

**ABSTRACT**

A method is disclosed for making the hook or loop part of a separable hook and loop type fastener by bending a flexible base strip having a plurality of unbroken hook-shaped rails protruding from one surface thereof into a generally tubular form with the rails extending radially inwardly thereof; and thereafter progressively subjecting spaced-apart cross-sectional segments of each rail alternately and periodically to a rotational cutting action to transform each rail into a row of individually spaced-apart resilient hooks or loops.

**7 Claims, 9 Drawing Figures**

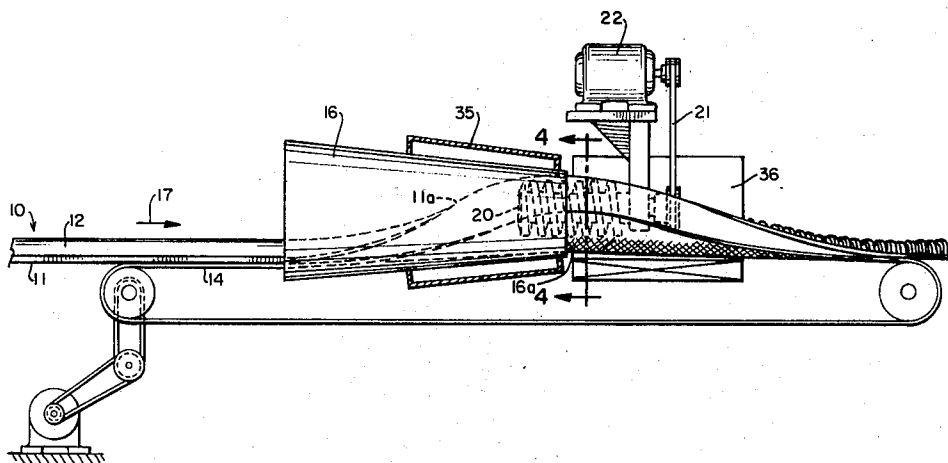


FIG. 1

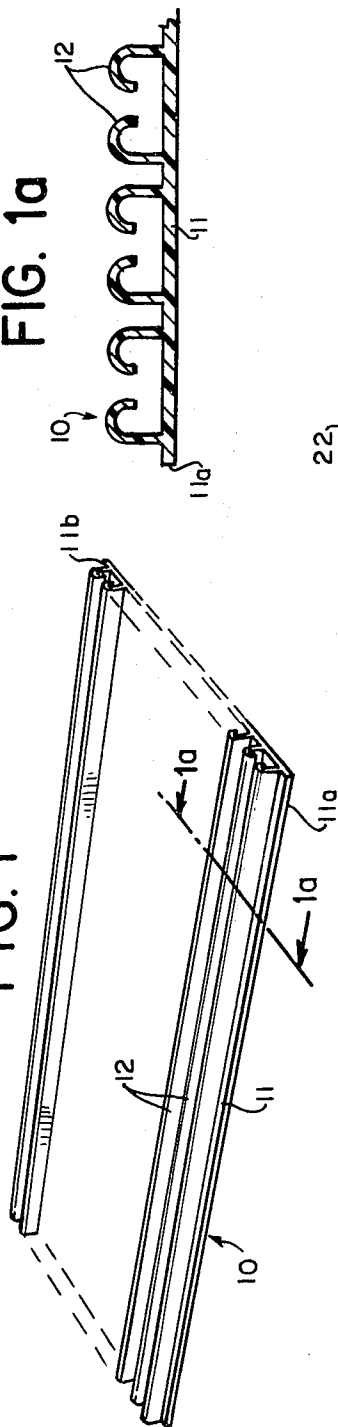


FIG. 1a

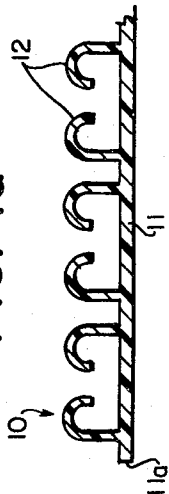
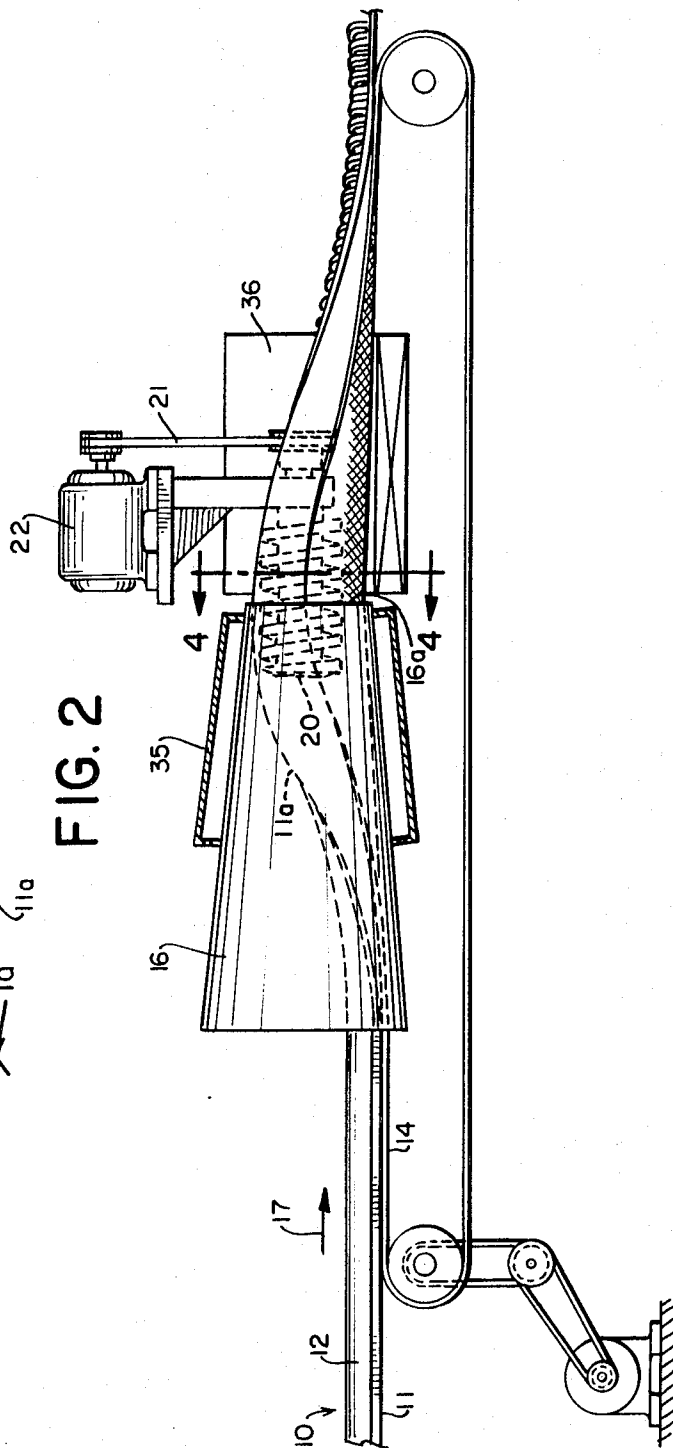


FIG. 2



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FIG. 3

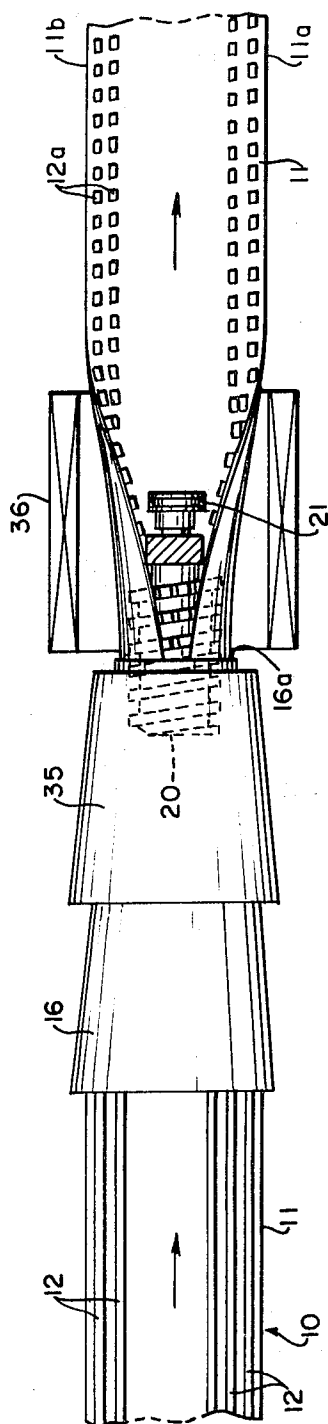


FIG. 5

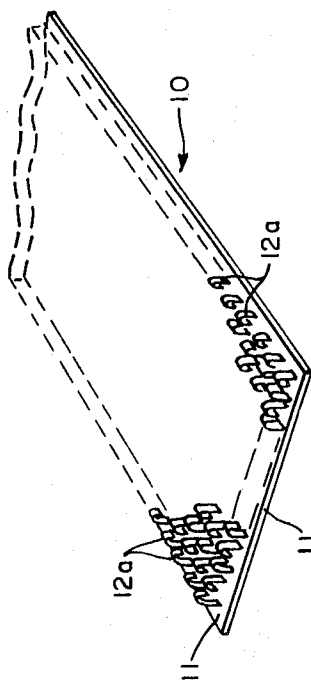
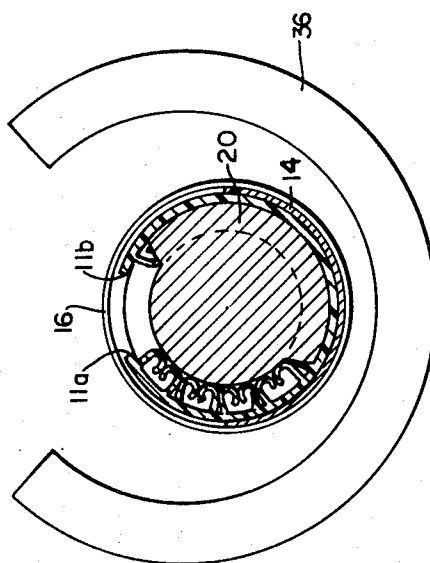


FIG. 4



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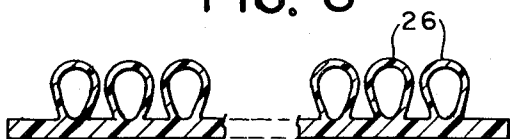
FIG. 6



FIG. 7



FIG. 8



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# METHOD AND APPARATUS FOR MAKING FLEXIBLE STRIPS OF MATERIAL HAVING A PILE OF HOOK-SHAPED ELEMENTS

## BACKGROUND OF THE INVENTION

This invention relates to separable fastening devices of the type wherein one part of the fastener has a multiplicity of small outwardly projecting loops of thin filamentary material and the other surface is provided with a multiplicity of curled or hook-like resilient projections. Such fasteners have been described in U. S. Pat. Nos. 2,717,437 and 3,009,235.

It will be understood that when two layers of this type are pressed into face-to-face contact, their respective hooks and loops interengage one within the other thereby securing said layers into locking engagement. Separation of the two layers requires a force of considerable magnitude when attempting to effect the separation of a large number of hooks and loops at once, but separation may be quite readily effected by progressively peeling the layers apart.

Fasteners constructed with interlocking hooks and loops of the type described find a wide variety of applications. For instance, they can be substituted for existing closing devices such as buttons, buckles, clasps, slidable fasteners of the type popularly termed zippers, or like attachments which are currently used in many diverse type of wearing apparel. In addition, they serve a useful function in many particular environments where it is desired to fasten one object to another in a quick and efficient manner.

In the past, the hooked surface of these fasteners has been formed by subjecting a multiplicity of loops to the cutting action of a device consisting of a comb of tapered needles having mounted thereon small rapidly reciprocating scissors-like cutters which clip each loop at a pre-determined point thereby resulting in a hook and stub formation which, due to the resilient nature of the filamentary loops, to a great extent resembles a snap hook configuration.

It is a principal object of this invention to provide an alternate method for producing a hooked surface of the type described which further utilizes an extruded starting material employing several possible hook-like forms or alternatively a loop form.

## SUMMARY OF THE INVENTION

In accordance with the teachings of the present invention, a length of flexible base material, in the form of an extruded strip or tape of any suitable composition, is provided with a plurality of upstanding integral rails extending generally lengthwise of the strip. Each rail has either a hook-shaped or loop-shaped cross-sectional configuration. The strip is bent into a generally tubular form with the upstanding rails projecting radially inwardly thereof. In this condition, each rail is subjected alternately to a translatory rotational cutting action wherein selected spaced-apart cross-sectional segments of each inwardly extending rail are periodically removed to transform each rail into a row of individually spaced-apart resilient hooks or into rows of loops.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of the starting tape according to the invention;

FIG. 1a is a cross-sectional view taken in the direction of arrows 1a—1a of FIG. 1;

FIG. 2 is an elevational view of the starting tape of FIG. 1 formed into a tube and subjected to internal cutting by an apparatus;

FIG. 3 is a top view of the starting tape and apparatus of FIG. 2;

FIG. 4 is a cross-section taken in the direction of arrows 4—4 of FIG. 2;

FIG. 5 is a fragmentary perspective view of the hook fastener tape material produced according to the present invention; and

FIGS. 6-8 are cross-sections of tape material showing different configurations of hook and loop elements formed in accordance with the present invention.

## DESCRIPTION OF PREFERRED EMBODIMENTS

With reference initially to FIGS. 1 and 1a of the drawing there has been disclosed a starter material 10 having a backing 11 and a series of rails 12 extending therefrom. In the illustrated embodiment the rails (as shown in FIG. 1a) are hook-like extensions which are integral with the backing rail 11 and are extruded integrally therewith of a suitable plastic material.

Referring to FIG. 2, the starter material 10 is passed along an endless belt 14 through a frusto-conical shaped forming die 16 which causes the starter material 10 gradually to be formed into a generally tubular shape. As the starter material moves in an axial direction in the direction of arrow 17, it will gradually ride up on the tapering circular inner surface of the die 16 to emerge from the smaller end 16a in a generally tubular form. The diameter of the smaller end of the die is slightly larger than the diameter of the circle which would be formed if the side edges 11a and 11b were brought into abutting contact.

This arrangement provides a tubular form with a gap which permits the tubular form to pass without interference with the gear belt 21 connecting the cutter 20 to the motor 22. The cutter 20 is formed as a helix so that as the starter material 11 progresses past the cutter, the rails 12 will be cut progressively and will produce a series of upstanding hooks 12a as shown in FIG. 5. In the particular, illustrated embodiment, there has been provided a cooling means schematically indicated as surrounding the forming die 16 which will increase the rigidity of rails 12 so that these may be cut more readily. After cutting, the material 10 and hooks 12a will pass through a suitable heating means 36 which will return the material to its original or ambient temperature.

It should be noted that the term "hook-shaped rail" as used in the specification and claims is intended to signify any upstanding unbroken rail which when cut in the manner herein disclosed will produce a row of individual, spaced apart, and upstanding elements which are suitable for use as the hooks of the hook member of a hook and loop type separable fastener. For instance, as shown in FIG. 6 upstanding rails 24 are shaped respectively as arrowheads, and in FIG. 7 the rails 25 are formed as double-hooks.

In the foregoing description of this invention, reference has been made to the fact that the transverse bending of the starting tape into a tubular form and movement of the tubular form longitudinally in partially encircling relationship to the fixed rotary cutter is accomplished simultaneously. It should be noted, however, that these steps may be performed sequentially. Thus, the starting tape may be bent into a generally tubular form and secured in a fixed position on a stationary table. Thereafter the rotating cutter may be moved axially through the tubular form to remove spaced-apart cross-sectional segments of each rail in the manner described above. Alternatively, the starting tape may be first bent into a tubular form and thereafter moved past a fixed rotating cutter in partial encircling relationship thereto, to produce the ultimate hooks. It should further be appreciated that while bending of the material into tubular form is a preferred method, nevertheless the material can be cut in accordance with the broad principles of the invention while it is flat.

It should also be understood that while the method herein disclosed has been described with particular reference to producing the hook member of a separable hook and loop type fastener, it should also be recognized that the method of this invention is equally well suited to producing the loop member of a separable hook and loop type fastener. When the method of this invention is so used, the upstanding hook-shaped rails may be merely replaced by a series of unbroken and upstanding loop-shaped rails 26 shown in FIG. 8.

While a preferred specific embodiment of the invention has been heretofore described, it is to be clearly understood that

various modifications, in addition to those specifically mentioned, can be made in the details of the invention described herein without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A method for making the hook member of a separable hook and loop type fastener comprising:

- a. providing a base material with a plurality of upstanding spaced-apart, and unbroken rails extending lengthwise of said base material, each rail having a generally hook or loop shaped cross-sectional configuration;
- b. progressively cutting away spaced-apart cross-sectional segments of each rail to thereby transform each rail into a row of individual spaced-apart hooks or loops.

2. The method according to claim 1 wherein said base material is cooled in order to make said rails more rigid prior to cutting said segments.

3. The method according to claim 1 wherein said base material is bent transversely into tubular form with said rails extending radially inwardly thereof prior to cutting said rails.

4. The method according to claim 3 wherein the step of cutting away said segments is accomplished by subjecting each

rail alternately and periodically while in said tubular form to the rotational cutting action of a rotary cutter disposed within said tubular form, said cutter being adapted to remove selected spaced-apart cross-sectional segments of each rail upon contact therewith.

5. The method according to claim 4 wherein said tubular form is fixed with respect to said rotating cutter, said rotating cutter being moved axially through said tubular form to alternately and periodically cut away spaced-apart cross-sectional segments of each rail to form said row of individual spaced-apart hooks or loops.

6. The method according to claim 4 wherein said rotating cutter is fixed in a translational sense with said tubular form being moved past said rotating cutter in at least a partially encircling relationship thereto, thereby cutting away spaced-apart cross-sectional segments of each rail to form said rows of hooks or loops.

7. The method according to claim 6 wherein the steps of bending the base material and cutting away spaced-apart cross-sectional segments of each rail are performed substantially simultaneously with each other.

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