United States Patent [19]

Green

[11] **3,777,966**

[45] **Dec. 11, 1973**

[54] **MEANS FOR SETTING GROMMETS IN WOVEN FABRICS**

[76] Inventor: **Victor J. Green,** 8121 Barkley Dr., Houston, Tex. 77017

[22] Filed: **Feb. 12, 1970**

[21] Appl. No.: **10,712**

[52] **U.S. Cl.** **227/61,** 29/243.52, 29/243.54, 29/432.2, 29/512

[51] **Int. Cl.** **B21j 15/14**

[58] **Field of Search** 223/104, 103; 29/432, 243.52, 432.2, 243.54, 512; 227/61, 62

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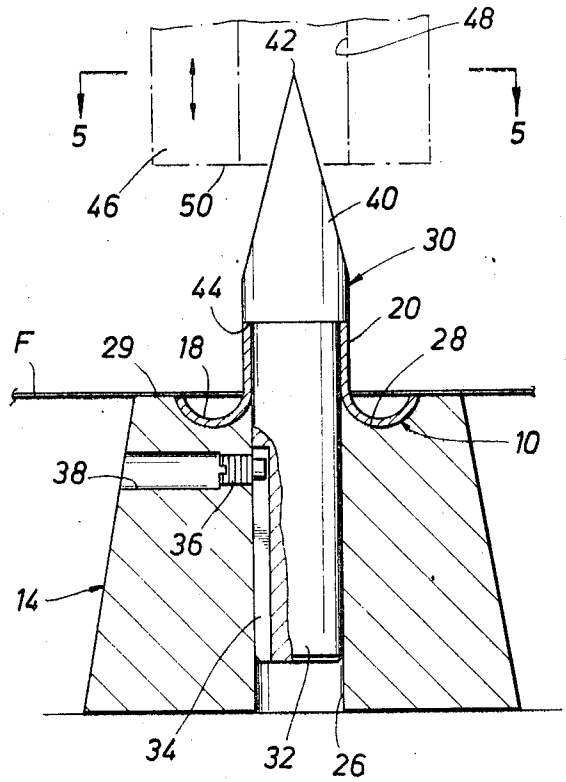
Primary Examiner—George H. Krizmanich
Attorney—Charles E. Lightfoot

[57] **ABSTRACT**

A method of and apparatus for setting grommets in woven fabrics without cutting strands of the fabric, or with the cutting only of strands of the fabric which extend in directions other than the direction of the pull which will be exerted on the fabric when the article is in use. The apparatus includes a fabric penetrating device designed to be used in conjunction with grommet setting tools to form an opening in the fabric by penetrating the fabric between the strands or moving strands or threads of the fabric apart without severing the same to permit the insertion in the opening of one part of a grommet to be set in the fabric. The penetrating device may have a cutting edge positioned to cut a limited number of strands or threads of the fabric extending in a direction normal to the direction of the pull which will be exerted on the fabric during use of the article formed therefrom, in order to facilitate the penetration of the fabric to form the grommet opening therein without severing strands upon which the pull will be exerted.

The method of the invention comprises forming a grommet receiving opening in a woven fabric by inserting a penetrating device therethrough between strands of the fabric to separate the strands without cutting the same, and inserting and setting a grommet in the opening so formed. The method may include the cutting of a limited number of strands of the fabric which extend in directions other than the direction in which strands of the fabric would be subjected to a pulling force in the use of the article of which the fabric is formed.

5 Claims, 5 Drawing Figures



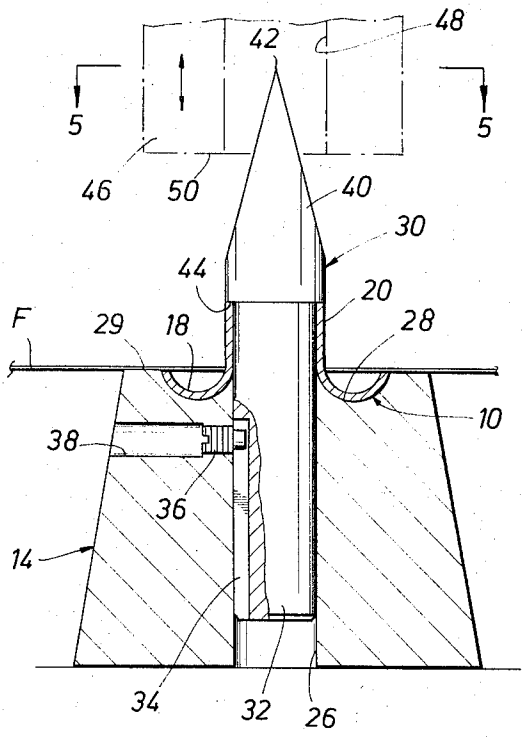


FIG. 1

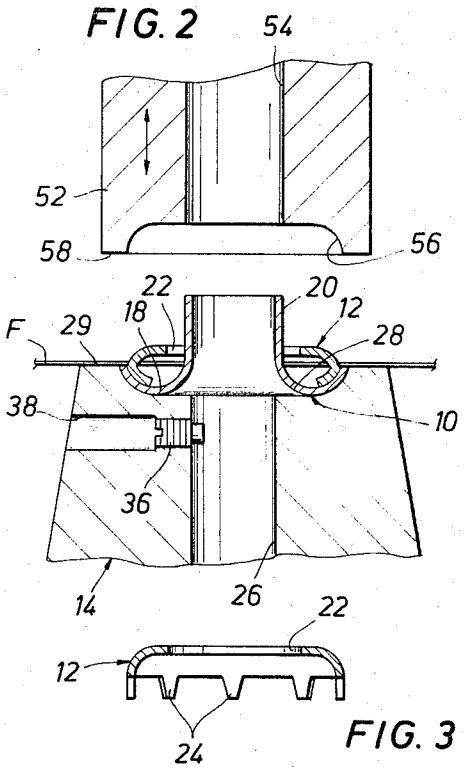


FIG. 2

FIG. 3

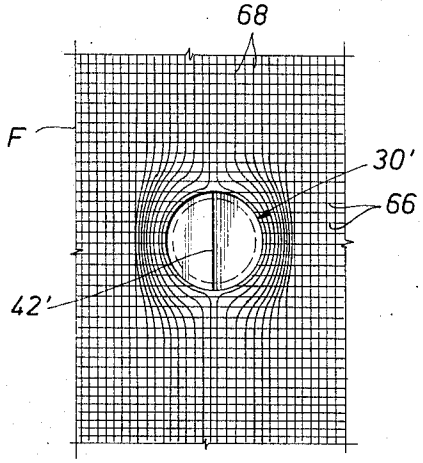


FIG. 5

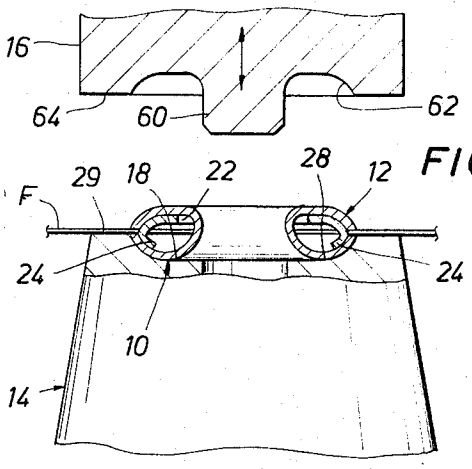


FIG. 4

Victor J. Green
INVENTOR

BY Charles E. Lightfoot
ATTORNEY

MEANS FOR SETTING GROMMETS IN WOVEN FABRICS

BACKGROUND OF THE INVENTION

In the making of numerous articles of woven fabric it is customary to furnish such articles with grommets or eyelets for the attachment of ropes or other fastening means. Articles of this character, such as tents, tarpaulins, and especially apparatus of the flexible fabric bed type, such as trampolines, the fabric is maintained in a more or less tightly stretched condition and is often subjected to great pulling forces tending to pull the fabric away from the grommets resulting in the pulling out of the grommets.

For the purpose of attaching grommets to such articles it is customary to cut holes in the fabric, by the use of a cutter of the punch type, which severs the strands or threads of the fabric, leaving loose ends about the margins of the holes, the grommets being then inserted in the holes and set in place to clamp the fabric surrounding the holes.

When an article constructed in this manner is subjected to pulling forces, such as are exerted by ropes, springs, or the like extending through the grommets, the strands extending in the direction of the pull are frequently pulled away from the grommets, resulting in damage to the fabric and finally rendering the article unfit for further use.

SUMMARY OF THE INVENTION

Briefly described, the present invention comprises a method of and means for applying grommets to a woven fabric, in which the strands of the fabric are left in an unsevered condition or in which only a limited number of strands extending in directions other than the direction of the exertion of the greatest pull on the fabric are cut to facilitate the insertion and setting of the grommet.

The apparatus of the invention includes, in addition to grommet setting means of a usual type, a device which is designed to penetrate the fabric and shaped to push the strands aside without severing any of the strands, or to cut a limited number of the strands extending only in directions other than the direction in which the greatest pulling force will be exerted on the fabric, to form an opening through which the grommet may be extended.

The grommet setting apparatus may be of the type having the usual parts, such as an anvil and a hammer or setting element and the hole forming member may be a pointed element carried by the anvil in position to penetrate the fabric when the fabric is pressed over the anvil to form the grommet receiving opening. The hole forming member amy also be formed with a cutting edge at its free end by which strands of the fabric may be cut to facilitate the forming of the grommet hole, and means is provided for holding the member in a predetermined position in the anvil to position the cutting edge to sever only strands of the fabric extending in directions other than the direction of the pull which will be exerted on the fabric article in use.

The method of the invention comprises the attachment of a grommet to a woven fabric by forming an opening in the fabric, without severing strands of the fabric, by pushing aside the strands in the location of the opening, inserting a grommet through the opening and setting the grommet into clamping engagement with the strands about the margin of the opening. The method may include the forming of the grommet opening in the fabric by severing a limited number of strands extending in one direction only of the fabric to facilitate the penetration of the fabric and the pushing aside of the strands to form an opening through which the grommet may be inserted to position the grommet for setting into clamping engagement with the strands about the opening.

BRIEF DESCRIPTION OF THE VIEWS OF THE DRAWINGS

In the drawings

FIG. 1 is a side elevational view, partly broken away and partly in cross-section, illustrating a preferred embodiment of the grommet setting apparatus of the invention and the method of setting a grommet therewith, the parts being shown in the positions which they occupy at a stage in which one part of a grommet is positioned in an opening in the fabric preliminary to the application of the other part and the setting of the grommet;

FIG. 2 is a view similar to that of FIG. 1 showing the apparatus with the parts of the grommet in an intermediate stage of the setting operation ready for the completion of the setting of the grommet;

FIG. 3 is a central, vertical, cross-sectional view of one part of the grommet, prior to the setting of the same;

FIG. 4 is a view similar to that of FIG. 1 the apparatus at the completion of the setting operation; and

FIG. 5 is a cross-sectional view, taken along the line 5—5 of FIG. 1, looking in the direction of the arrows.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE GROMMET SETTING MEANS AND THE METHOD OF USING THE SAME

The invention as illustrated in the drawings is intended for use in applying grommets or eyelets to articles formed of woven fabric, such as the fabric shown at F, which may be of any usual type, such as canvas or other woven fabric. The invention finds particular utility in connection with woven fabrics used in the making of articles which are designed to withstand relatively great pulling or stretching forces, such as tents, tarpaulins or the flexible beds or trampolines or devices of similar character in which woven fabrics formed of plastics having great strength and resistance to stretching are frequently used.

In the manufacture of devices of this character grommets of various kinds are employed, such as that illustrated in the drawings having a base or eyelet part **10** which is constructed to be inserted through an opening in the fabric, and a part or washer **12** which is adapted to be positioned over the base, the parts being shaped for coaction by crimping or setting with setting apparatus such as the anvil **14** and hammer **16** to clamp the fabric about the opening between the parts to securely attach the grommet to the fabric.

The base or eyelet part **10** of the grommet is formed with an annular portion or flange **18** which is of generally U-shape in cross-section, and a tubular neck portion **20** which is concentric with the flange and which is coextensive with the inner wall portion thereof and beyond the free edge of the outer wall portion of the flange.

The washer part **12** of the grommet, best seen in FIG. **3**, is of generally inverted cup shape having a central

opening 22 through which the neck 20 of the base part may be freely extended, and formed with a depending rim portion provided with circumferentially spaced projections 24 about its outer periphery.

The anvil or die 14 is of annular, tapered shape, formed with a central bore 26 and having at its upper end an annular cavity 28 surrounding said bore and which is shaped to correspond to the shape of the flange 18 and in which the eyelet part 10 may be seated. The anvil also has a planar end face 29 surrounding the cavity 28 for engagement with the lower surface of the fabric about the grommet opening formed therein.

A fabric penetrating or hole forming member or tool 30 is provided, which is formed with a shank portion 32 which fits in the bore 26 and has an external, longitudinal groove 34 into which a set screw 36 threadably carried in a side opening 38 of the anvil may be extended to releasably hold the member against rotation in the anvil. The hole forming member has a somewhat enlarged head portion 40 at its upper end which may be upwardly tapered to form a penetrating point 42 at the free end of the member and which also provides an external downwardly facing shoulder 44 positioned to be seated on the upper end of the neck portion 20 of the base part 10 of the grommet as shown in FIG. 1.

A fabric operating member 46 is provided, which coacts with the penetrating member to form an opening in the fabric for the reception of the neck of the grommet part 10, as illustrated in FIG. 1. The member 46 is of generally tubular shape, having a central bore 48 of a size to conveniently fit the head 40 of the penetrating member 30 and formed with an annular, planar end face 50 which presses the fabric surrounding the hole formed therein by the penetrating member against the upper end face of the anvil 14 when the operating member 46 moves downwardly over the point 42 to the anvil.

It will be apparent that the penetration of the fabric F by the member 30 by downward movement of the operating member 46 over the head 40 with the end face 50 of the member 46 in engagement with the upper surface of the cloth to press the cloth down against the anvil represents an initial stage of the method of the invention by which a hole is formed in the fabric and the neck portion of the eyelet part 10 of the grommet is extended through the hole.

The grommet setting apparatus includes a washer setting die or hammer 52, shown in FIG. 2, which may be of cylindrical shape, having a bore 54 of a size to conveniently receive the neck 20 of the grommet part 10 and formed with an annular end cavity 56 conforming to the shape of the washer part 12 above the projections 24 and in which the washer may be partially extended. The washer setting tool also has an end face 58 surrounding the cavity 56 which is engagable with the fabric F about the washer when the tool is moved downwardly to crimp or set the washer in the eyelet part as illustrated in FIG. 2.

In a stage of the grommet setting method of the invention, subsequent to the stage illustrated in FIG. 1, the washer part 12 is positioned over the neck portion 20 with the free ends of the projections 24 resting on the upper surface of the fabric slightly radially inwardly of the outer periphery of the flange 18 of the eyelet part, and the setting member 52 is then moved downwardly over the neck 20 to press the washer downwardly against the flange 18 to turn the projections 24 inwardly in the curved annular portion of the flange.

The grommet setting apparatus also includes hammer or setting die 16, previously mentioned which may be of solid, cylindrically shaped construction having a central, downwardly extending, end projection 60, of a size to snuggly fit within the neck 20, and an annular end cavity 62 surrounding the projection and whose bottom is curved. Radially outwardly of the cavity 62 the hammer 16 has an end face 64 positioned for engagement with the upper surface of the fabric F when the hammer reaches the limit of its downward setting movement toward the anvil, and downwardly beyond which the projection 60 may extend.

As will be evident from FIG. 4 a further stage of the method of the invention is the setting of the grommet by the downward movement of the hammer 16 into engagement with the free end of the neck 20 of the eyelet part 10 positioned as shown in FIG. 2, to turn the wall of the neck outwardly and downwardly by engagement in the cavity 62 to interengage the parts with the fabric clamped tightly between the washer and eyelet parts about the opening in the fabric whereby the grommet will be securely attached to the fabric.

In carrying out the grommet applying method of the invention, making use of the above described apparatus, the eyelet part 10 of a grommet is positioned in the cavity 28 of the anvil, as seen in FIG. 1, and the shank 32 of the penetrating member 30 is inserted through the neck 20 into the bore 26 of the anvil with the shoulder 44 resting upon the free end of the neck.

The fabric F is then placed on the penetrating member with the point at which the grommet is to be applied disposed on the point 48 of the member, and the fabric operating member 46 is pressed downwardly over the point 48 to cause the point to penetrate the fabric between strands of the same and to move the fabric downwardly over the head 40 to separate strands of the fabric without cutting the same, to form a hole in the fabric and move the fabric down over the neck 20 into engagement with the end face 29 of the anvil with the neck 20 extending through the hole.

It will be apparent that, as the fabric moves downwardly along the tapering face of the pointed head 40, the strands of the fabric will be moved apart to form a hole about which the strands of the fabric will be somewhat curved and bunched, in the manner shown in FIG. 5, but without cutting or breaking the strands.

With the grommet hole thus formed in the fabric the penetrating implement 30 may be readily removed from the anvil, leaving the neck 20 projecting through the fabric.

If desired, a suitable cementing material or other adhesive, such as plastic dissolved in a suitable solvent, or other adhesive, may be applied to the fabric about the opening therein to further hold the strands in position.

The washer part 12 is next placed over the neck 20 with the free ends of the projections 24 resting on the upper surface of the fabric at locations slightly inwardly radially of the outer periphery of the flange 18, and the washer setting member 52 is pressed downwardly to extend the neck 20 into the bore 54 and engage the washer in the cavity 56 to press the washer downwardly against the eyelet part to cause the projection 24 to be turned inwardly in the flange 18 to bind the fabric between the eyelet and washer parts, as seen in FIG. 2.

With the parts of the grommet thus pressed into clamping engagement with the fabric, the hammer 16 is positioned on the neck 20 with the central projection 60 fitted into the neck and the hammer is then driven downwardly toward the anvil to overturn the wall of the neck by engagement in the cavity 62 against the upper surface of the washer part to clamp the fabric between the parts.

Under some conditions, such as in the setting of grommets in heavy fabrics or fabrics woven of very stiff material or closely woven plastic material in which it is difficult to penetrate the material to move the strands or threads apart in forming the grommet openings it may be desirable to cut a limited number of the strands or threads which will not be subjected to the greatest pulling force to which the fabric will be subjected in the use of the article formed therefrom, in order to facilitate the penetration of the hole forming device. For this purpose a penetrating member 30', similar to the member 30, previously described, may be provided, which is furnished with a cutting edge 42' instead of the penetrating point 42, as shown in FIG. 5. In other respects the member 30' is the same as the member 30 and is similarly used.

In using the member 30' the fabric is urged downwardly against the cutting edge 42' by the operating member 46 with the fabric disposed in a predetermined position of orientation relative to the cutting edge, to cut a number of the strands or threads, such as the strands 66 of the fabric, which extend in directions other than the direction of the greatest pull which will be exerted on the fabric.

The form of the fabric penetrating element illustrated in FIG. 5 is held in a predetermined position in the anvil by the screw 36 in the slot 34, as shown in FIG. 1 to cut only strands of the fabric extending in a direction other than the direction of the pull which will be exerted on the fabric in use. Thus, the cutting edges 42' will contact the fabric in a position of orientation relative to the strands of the fabric to cut only strands extending in directions other than the direction of pull on the fabric.

In the present illustration, the direction of the maximum pull on the fabric may, for example, be parallel to the strands 68, while the strands 66 may be disposed generally normal to the strands 68, so that the strands 66 bear only a minor portion of the pull on the fabric. Thus, by leaving the strands 68 uncut, these strands will be pushed aside and bunched about the grommet opening as seen in FIG. 5, so that the fabric is not substantially weakened, and the strands will not be pulled away from the grommet. The cutting of a limited number of the strands 66 greatly facilitates to penetration of the hole forming implement without substantially reducing the strength of the fabric or the clamping of the fabric by the grommet.

In other respects the method of applying the grommets to the fabric using the penetrating implement of FIG. 5 is the same as that described in connection with the use of the penetrating implement of FIG. 1.

The method of the invention may thus comprise the forming of a hole in the woven fabric without cutting the strands or threads of the same; the inserting of the neck of an eyelet-like grommet part having a tubular neck through the hole; the positioning of a washer-like grommet part over the neck in engagement with the upper surface of the fabric around the hole and the crimping or setting of the washer-like part into interlocking engagement with the eyelet-like part to clamp the fabric between the parts; and the setting of the grommet parts by overturning the wall of the tubular neck into engagement with the washer-like part to securely clamp the parts to the fabric.

The method of the invention may also comprise the cutting of a limited number of the strands of the fabric extending in directions other than the direction of the pulling force which will be exerted on the fabric in the use of the article formed therefrom, leaving the strands which will bear such pulling force severed, thus avoiding weakening of the fabric and the danger of pulling the fabric away from the grommet in use.

It will thus be seen that the invention provides means for applying a grommet to a woven fabric by which an improved attachment is formed, as well as a method of applying such grommets without cutting holes in the fabric or otherwise reducing the strength of the same.

Having thus clearly shown and described the invention, what is claimed as new and desired to secure by Letters Patent is:

1. A fabric penetrating implement for applying grommets to articles formed of woven fabrics which comprises:

an anvil having a central bore and having at its upper end an annular cavity surrounding said bore,

an eyelet part of a grommet formed with an annular portion having the shape of said annular cavity and a tubular neck portion extending above said cavity, and

a fabric penetrating means having a tapered head portion terminating at a point and having a shank portion of reduced size relative to said head and defining a grommet engaging shoulder at the base of said head portion,

said base of said head portion seated on said tubular neck portion of said eyelet part of said grommet and said shank portion passing through the annulus of said eyelet part of said grommet and extending into said bore of said anvil.

2. An implement according to claim 1 wherein said head portion has a diameter at the base which is the same as the outer diameter of the tubular neck portion of said grommet.

3. An implement according to claim 1 wherein said anvil has means which extends into said central bore whereby said fabric penetrating means is held against axial rotation.

4. An implement according to claim 3 wherein said shank of said fabric penetrating means has a slot in which said means for holding against rotation cooperates.

5. An implement according to claim 1 wherein said head portion of said fabric penetrating means is tapered to a cutting edge.

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