April 12, 1960 L. RIDGWAY 2,932,073

FASTENING DEVICE

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FIG. 1.

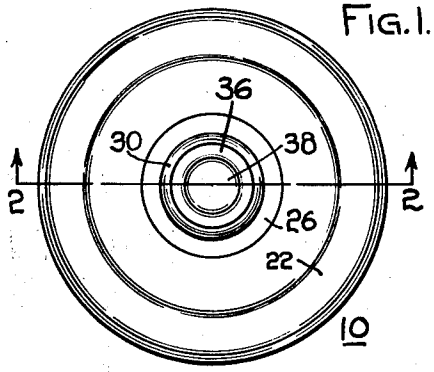


FIG. 2.

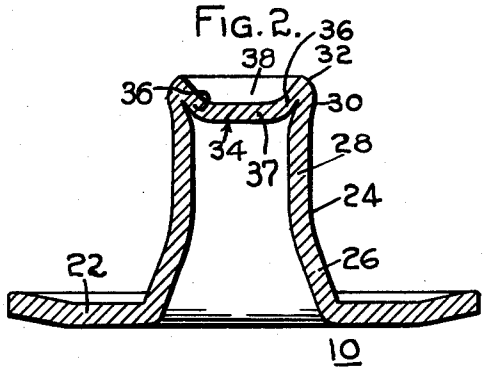


FIG. 3.

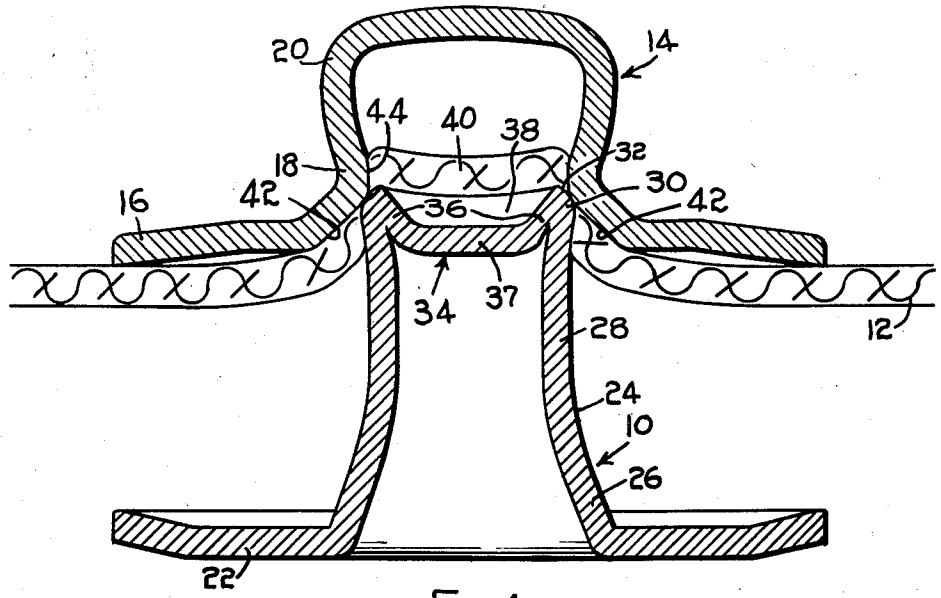
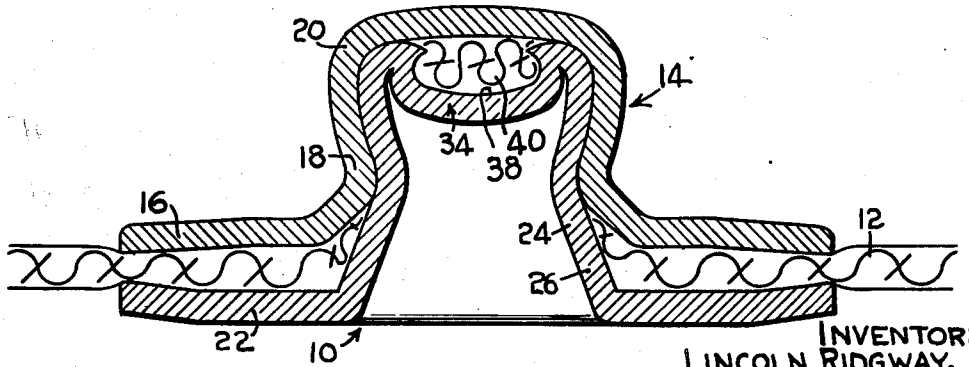


FIG. 4.



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FIG. 5.

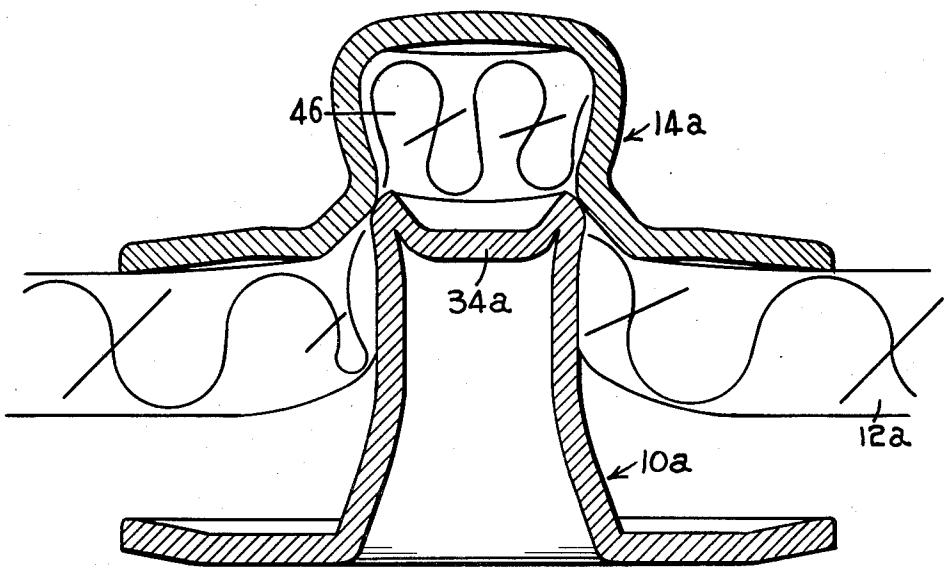
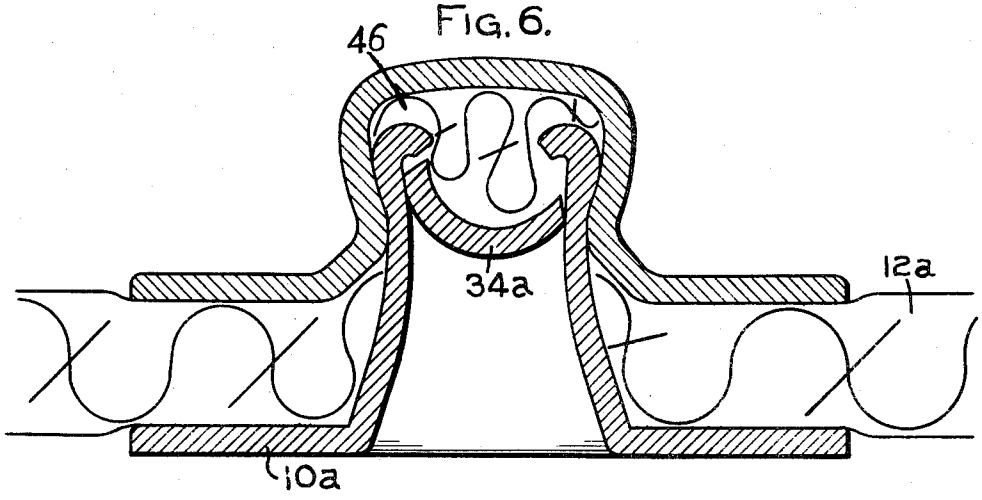


FIG. 6.



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2,932,073

FASTENING DEVICE

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Application March 26, 1956, Serial No. 573,905

4 Claims. (Cl. 24—219)

This invention relates generally to fastening devices and has particularly reference to an eyelet for attaching a hollow stud to a supporting sheet of material.

Many types of snap fastener devices utilize a stud which is formed by drawing a sheet of metal to provide a hollow head portion. Studs of this type are usually attached by an eyelet which has a shank adapted to pierce the sheet and expand inside the head of the stud. Such eyelets are ordinarily provided with a hollow tubular end portion having a periphery as sharp as possible to pierce a hole through the sheet of material and crumple or flare outwardly inside the hollow head of the stud, retaining the stud in position on the sheet.

However, it has been found that when studs and eyelets of the ordinary type are applied to a sheet of material formed of woven fibers of a tough material such as nylon, an unsatisfactory attachment is frequently obtained. In most of such cases it is found that the end of the eyelet is not sharp enough to cut all the individual strands in the material, with the result that some of the strands are drawn up between the eyelet and the inside wall of the neck of the stud. This frequently causes the neck of the stud to so enlarge that the stud is thereafter incapable of snapping engagement into a socket, and it also has the disadvantage of causing puckering of the material adjacent the stud.

In an effort to overcome this difficulty, eyelets have been made which have a piercing end substantially the same size as the internal aperture in the neck of the stud so that all the individual strands will be cut between the end of the eyelet and the wall neck of the stud. This solution has been found unsatisfactory since it is impractical to form an end on the eyelet sufficiently sharp to insure that each strand is cut, and in many cases the strands cause the eyelet to collapse inwardly with the same effect mentioned before.

However, I have found unexpectedly that if instead of attempting to cut the strands of the material with an eyelet with a sharp end, more satisfactory results can be obtained by using an eyelet with a blunt end. Although the reasons for this are not entirely clear, it is my belief that the strands are mashed between the end of the eyelet and the wall of the neck of the stud and are thereby so weakened that they separate easily.

The construction of an eyelet to accomplish this created other problems which will be discussed hereinafter.

The object of the invention is to provide an eyelet for assembly with a hollow headed snap fastener stud which is capable of clearly piercing a hole in material formed of fibers of tough material such as nylon or the like.

A further object of the invention is to provide an eyelet for the purpose described which has means at the piercing end to resist inward crushing forces, with said means being separable therefrom by an axial force, which may occur during attachment to excessively thick material.

A further object of the invention is to provide an eyelet for the purpose described which is so constructed as

to prevent foreshortening thereof during attachment with a stud.

Other objects of the invention will be obvious from the following description of a specific embodiment of the invention.

In the drawing:

Fig. 1 is a top plan view of an eyelet embodying the features of the invention;

Fig. 2 is a view in section taken on line 2—2 of Fig. 1;

Fig. 3 is a view in section illustrating the assembly of a stud and eyelet with a supporting sheet of medium thickness;

Fig. 4 is a view in section illustrating the parts of Fig. 3 after assembly is completed;

Fig. 5 is a view in section similar to Fig. 3 illustrating the assembly of a stud and eyelet with a supporting sheet having a thickness greater than that of the sheet of Fig. 3; and

Fig. 6 is a view in section illustrating the parts of Fig. 5 after assembly is completed.

Referring to the drawing, there is illustrated an eyelet **10** which is adapted for piercing a supporting sheet **12** to engage a stud **14**. The stud **14** for which the eyelet is designed for use comprises a base **16** having a hollow stud portion drawn upwardly from the center which comprises a neck portion **18** and an enlarged head portion **20**.

The eyelet **10** comprises a base **22** and a hollow drawn shank **24** extending upwardly therefrom. In the preferred embodiment the shank comprises a lower frusto-conical portion **26** and an upper cylindrical portion **28** which has an end portion **30** which is slightly enlarged and has an inwardly rounded, forwardly facing surface **32** for a purpose to appear hereinafter.

In the illustrated embodiment the end of the eyelet is provided with an internal support member **34** which comprises a peripheral portion **36** which is joined to the wall of the eyelet and extends inwardly and rearwardly therefrom so as to be substantially perpendicular to the surface **32** to a center portion **37** which is spaced rearwardly from the end of the eyelet forming a cavity **38**.

Referring to Figs. 3 and 4 of the drawing, there is illustrated a stud and eyelet at two different stages in the attachment to a sheet of material of medium thickness. In Fig. 3, the eyelet has been forced part way into the stud, and the forwardly and outwardly facing surface **32** has pinched off the material of the sheet against the inside of the neck of the stud.

To provide means for cooperating with the forwardly and outwardly facing surface **32** for pinching off a slug **40** of material, an inclined camming surface **42** is provided on the stud leading to a restricted neck. In the preferred embodiment the neck has been sized by inserting a suitable tool, resulting in a short cylindrical portion **44**. This insures that the most restricted portion of the stud neck is the proper size and substantially, perfectly round to cooperate with the enlarged head of the eyelet to insure that all fibers of the material are pinched off. It has been found desirable to make the outside diameter of the enlarged portion of the head slightly greater than the inside diameter of the cylindrical portion **44** of the neck. For example, an eyelet having a diameter at the enlarged portion of the head of .114 inch may be provided for use with a stud having an internal diameter at the neck of .108 inch providing an interference of .006 inch. Hence, during attachment the head must contract slightly and the neck of the stud must expand slightly. The amount of expansion and contraction necessary is easily accommodated by the stud and eyelet, and the tight fit therebetween insures that all of the individual fibers of the material are severed.

The provision of a cylindrical portion **44** of slightly

less diameter than the enlarged end portion 30 permits better recovery of the neck portion of the stud and permits the relief of a portion of the air trapped in the head of the stud which might otherwise hamper the lateral expansion of the eyelet.

As illustrated in Fig. 4, the attaching operation severs a slug 40 of material out of the sheet, and as the attachment proceeds, the slug 40 is trapped in the cavity 38 and forced against the top of the head of the stud where it assists in expanding the end of the eyelet inside the stud by serving as an anvil to prevent the inward collapse of the end of the eyelet.

Referring now to Figs. 5 and 6, there is illustrated two stages in the attachment of a stud 14*a* and an eyelet 10*a* embodying the features of the invention to a sheet of material considerably thicker than that shown in Figs. 3 and 4. In Fig. 5, it is seen that the stud and eyelet cooperate to punch out a slug 46 of material in the manner described hereinbefore. However, since the slug 46 is considerably thicker than the slug 40, there is not sufficient room between the end of the eyelet and the head of the stud to accommodate the slug. Hence, as the attachment proceeds, the internal support member 34*a* breaks away and is forced rearwardly. The greater thickness of the sheet 12*a* does not permit the eyelet to enter the stud far enough for the end of the eyelet to contact the head of the stud, however, the tightly packed slug 46 serves as an anvil to expand the end of the eyelet outwardly.

Hence by retaining the slug at the forward end of the eyelet instead of permitting it to pass down the center of the shank (as is the case with open ended eyelets), the assembly is made much more readily adaptable to great variations in material thickness. In extreme cases the depth of the inside of the head of the stud plus the thickness of the material can be greater than the length of the eyelet, which is not possible with an open-ended eyelet. As illustrated herein, when attaching medium or thin material, the end of the eyelet expands by coming up against the head of the stud. However, with thick material the eyelet need not hit the head of the stud, but uses the slug of material as an anvil. The internal support member, by being adapted to break away when subjeceed to a strong axial force by the packed slug, provides a safety valve to prevent damage to the head of the stud or deformation of the shank of the eyelet, yet is sufficiently resistant to radially inward forces to prevent inward collapsing of the end of the eyelet when the end of the eyelet is punching out the slug in the initial stage of the attachment. The force required to punch out a slug in the manner described is considerably greater than required to cut a slug with an open-ended eyelet, hence the shank of the eyelet must be designed to withstand the attaching force without collapsing or shortening. For this reason the cylindrical portion 28 rests on the conical portion 26 which in turn rests on the flange. Hence, the eyelet as seen in section is formed almost entirely of straight portions which provide a maximum resistance to axial forces.

Although designed to overcome problems in attaching tough materials such as nylon, the eyelet is also able to punch through conventional cloth materials and is also capable of piercing through sheet steel having a thickness of .018 inch.

Since certain other obvious modifications may be made in the device without departing from the scope of the invention, it is intended that all matter contained herein be interpreted in an illustrative and not in a limiting sense.

I claim:

1. An eyelet for self-piercing through a sheet of impermeable material and expanding into engagement with a hollow-headed stud having an inwardly inclined inner circumferential surface immediately adjacent the entrance of the stud head, said eyelet comprising a base, a hollow shank drawn upwardly from said base, said shank having a cylindrical portion and a radially enlarged cylindrical free end portion secured thereto, said free end portion having an inwardly rounded and forwardly facing outer surface for cooperating with the inclined inner surface of the stud head, and a circular internal support member secured to the free end portion in recessed relation thereto, said support member having a flat center portion lying below the perimetral edge of and secured to said end portion by an upwardly inclined peripheral wall portion, said eyelet when in fastening relation with said stud having the outwardly facing surface of said end portion cooperatively moving against the inner surface of said stud to punch out a slug of material, said slug being retained in the recessed support member of said end portion for pressing against the head of the stud and serving as an anvil to expand the end of said eyelet in the stud when assembling same.

2. An eyelet for self-piercing through a sheet of impermeable material and expanding into engagement with a hollow-headed stud having an inwardly inclined inner circumferential surface immediately adjacent the entrance of the stud head, said eyelet comprising a base, a hollow shank drawn upwardly from said base, said shank having a frusto-conical portion extending from said base and decreasing in diameter to a cylindrical portion, said cylindrical portion having a radially enlarged cylindrical free end portion, said free end portion having an inwardly rounded and forwardly facing outer surface for cooperating with the inclined inner surface of the stud head, and a circular internal support member secured to the free end portion in recessed relation thereto, said support member having a flat center portion lying below the perimetral edge of and secured to said end portion by an upwardly inclined peripheral wall portion, said eyelet when in fastening relation with said stud having the outwardly facing surface of said end portion cooperatively moving against the inner surface of said stud to punch out a slug of material, said slug being retained in the recessed support member of said end portion for pressing against the head of the stud and serving as an anvil to expand the end of said eyelet in the stud when assembling same.

3. An eyelet for self-piercing through a sheet of impermeable material and expanding into engagement with a hollow-headed stud having an inwardly inclined inner circumferential surface immediately adjacent the entrance of the stud head, said eyelet comprising a base, a hollow shank drawn upwardly from said base, said shank having a cylindrical portion and a radially enlarged cylindrical free end portion secured thereto, said free end portion having an inwardly rounded and forwardly facing outer surface for cooperating with the inclined inner surface of the stud head, and a circular internal support member secured to the free end portion in recessed relation thereto, said support member having a flat center portion lying below the perimetral edge of and secured to said end portion by an upwardly inclined peripheral wall portion, said center portion being separable from said support member by axial force applied thereto, said eyelet when in fastening relation with said stud having the outwardly facing surface of said end portion cooperatively moving against the inner surface of said stud to punch out a slug of material, the slug being retained in the recessed support member of said end portion for pressing against the head of the stud and serving as an anvil to expand the end of said eyelet in the stud when assembling same and prior to separating the center portion of said support member.

4. A stud and eyelet assembly for attachment to a sheet of impermeable material, said stud having a base and a hollow head drawn upwardly therefrom with a neck portion disposed between the head and the base, said neck having an internal cylindrical portion and an inwardly inclined inner circumferential surface extending from said base to said internal cylindrical portion and forming a

camming surface thereon, said eyelet comprising a base, a hollow shank drawn upwardly from said base, said shank having a cylindrical portion of a diameter substantially equal to the internal diameter of the cylindrical portion of the stud, and a radially enlarged cylindrical free end portion having a diameter slightly larger than said cylindrical portion but capable of passing through the internal cylindrical portion of the stud without substantial permanent deformation of either part secured thereto, said free end portion having an inwardly rounded and forwardly facing outer surface for cooperating with the formed internal camming surface of the stud head, and a circular internal support member secured to the free end portion in recessed relation thereto, said support member having a flat center portion lying below the perimetral edge of and secured to said end portion by an upwardly inclined peripheral wall portion, said eyelet when in fastening relation with said stud having the outwardly facing surface of said end portion cooperating

with the camming inner surface of said stud to punch out a slug of material, said slug being retained in the recessed support member of said end portion for pressing against the head of the stud and serving as an anvil to expand the end of said eyelet in the stud when assembling same.

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