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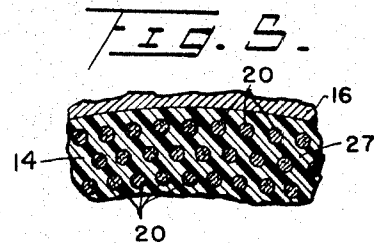
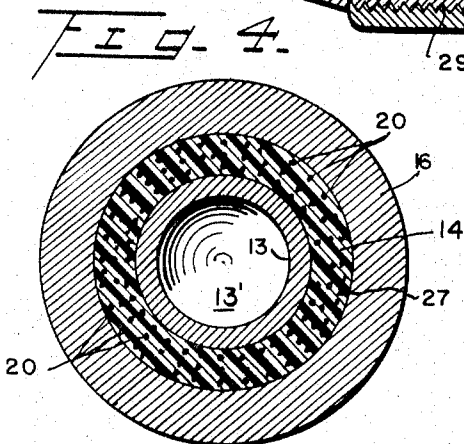
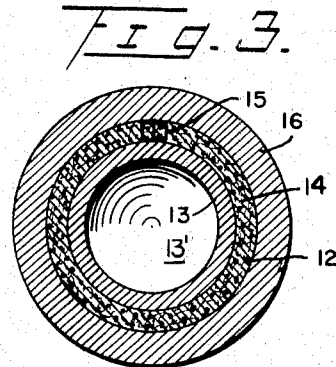
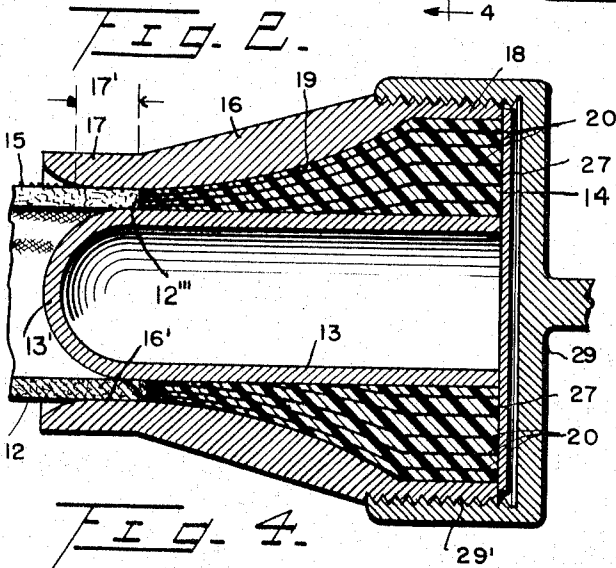
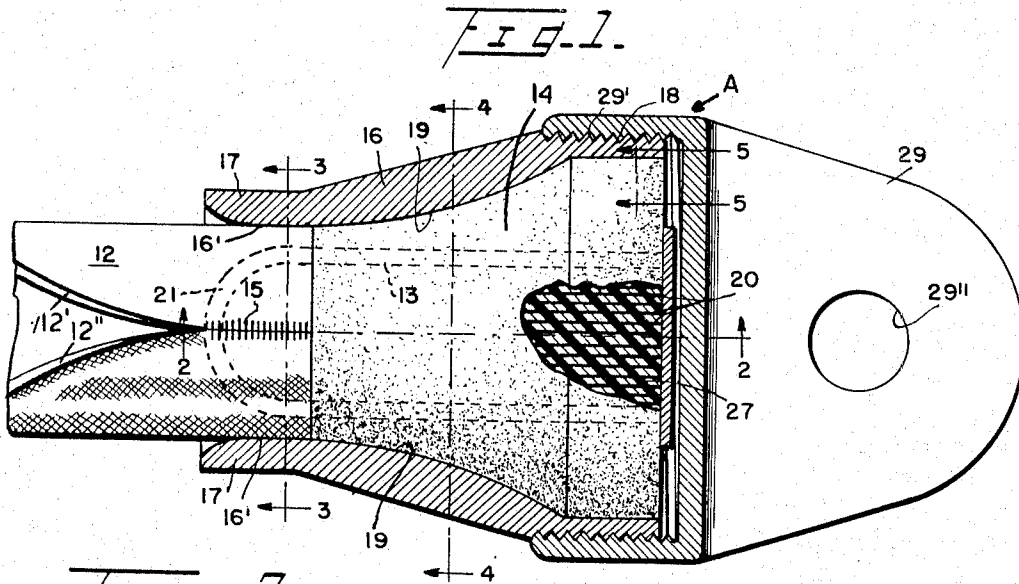
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3,333,310

BAND AND TAPE ANCHORING MEANS

Filed April 29, 1965

4 Sheets-Sheet 1



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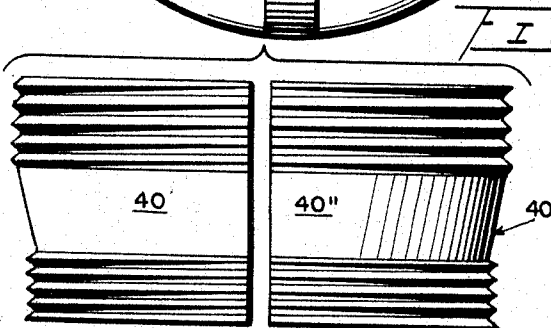
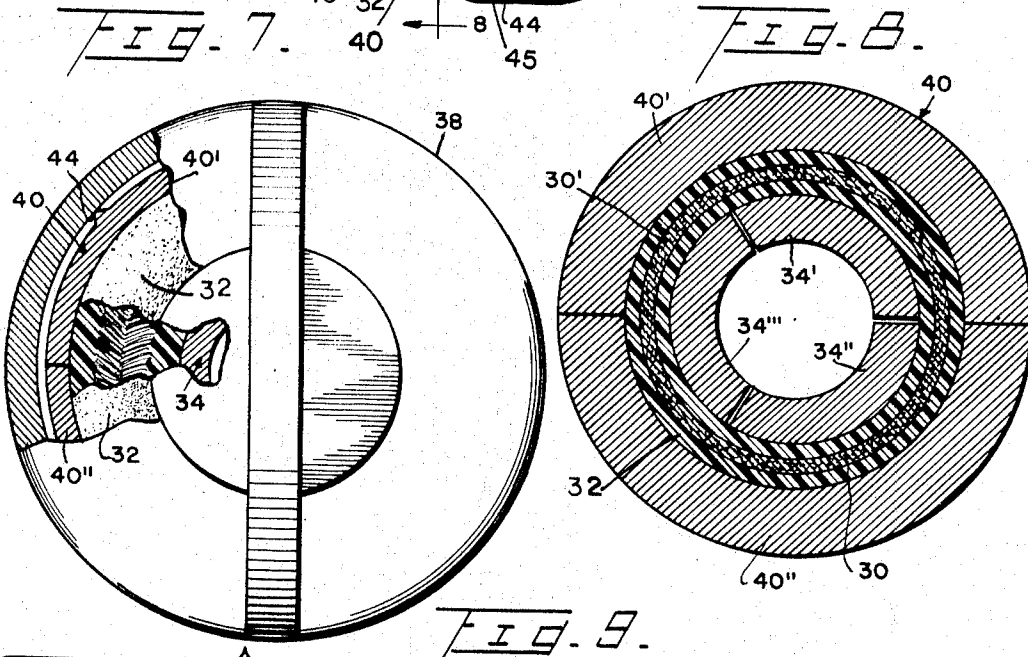
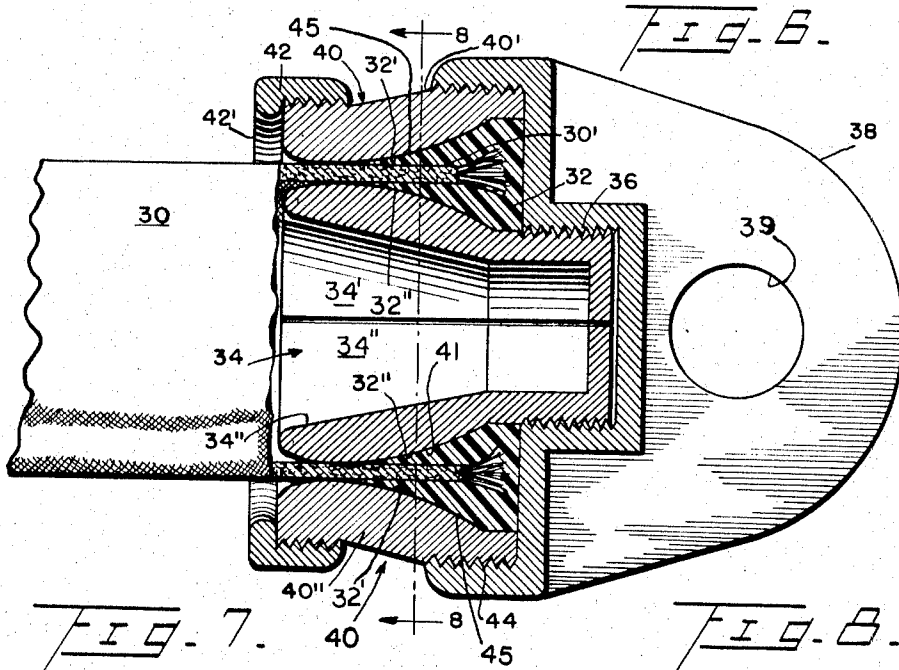
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3,333,310

BAND AND TAPE ANCHORING MEANS

Filed April 29, 1965

4 Sheets-Sheet 2



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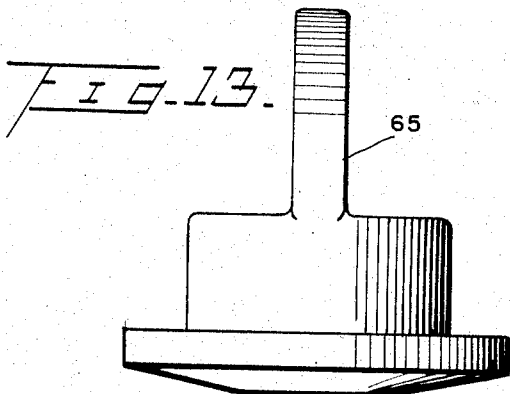
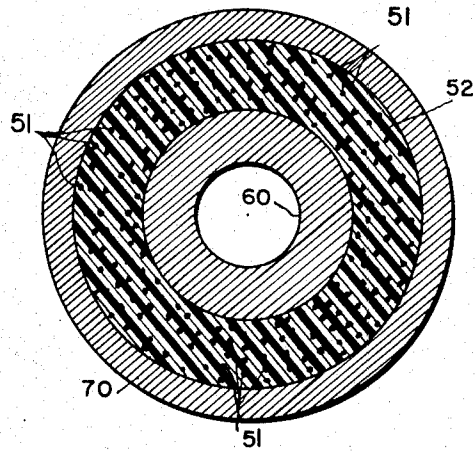
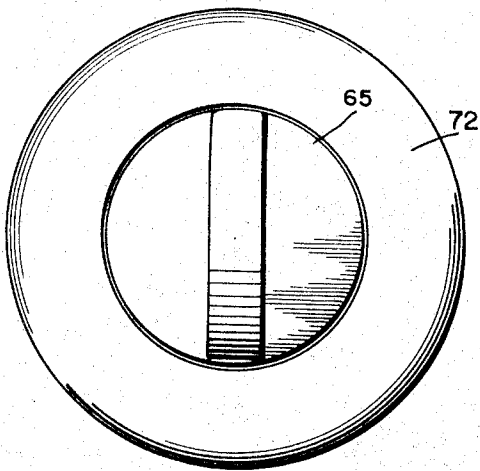
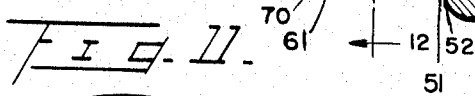
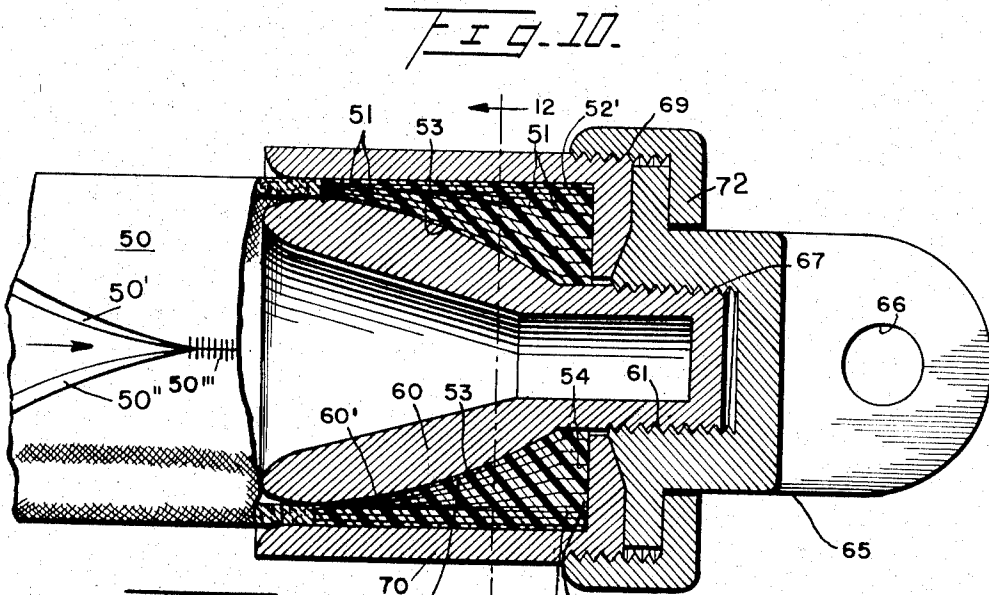
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3,333,310

BAND AND TAPE ANCHORING MEANS

Filed April 29, 1965

4 Sheets-Sheet 3



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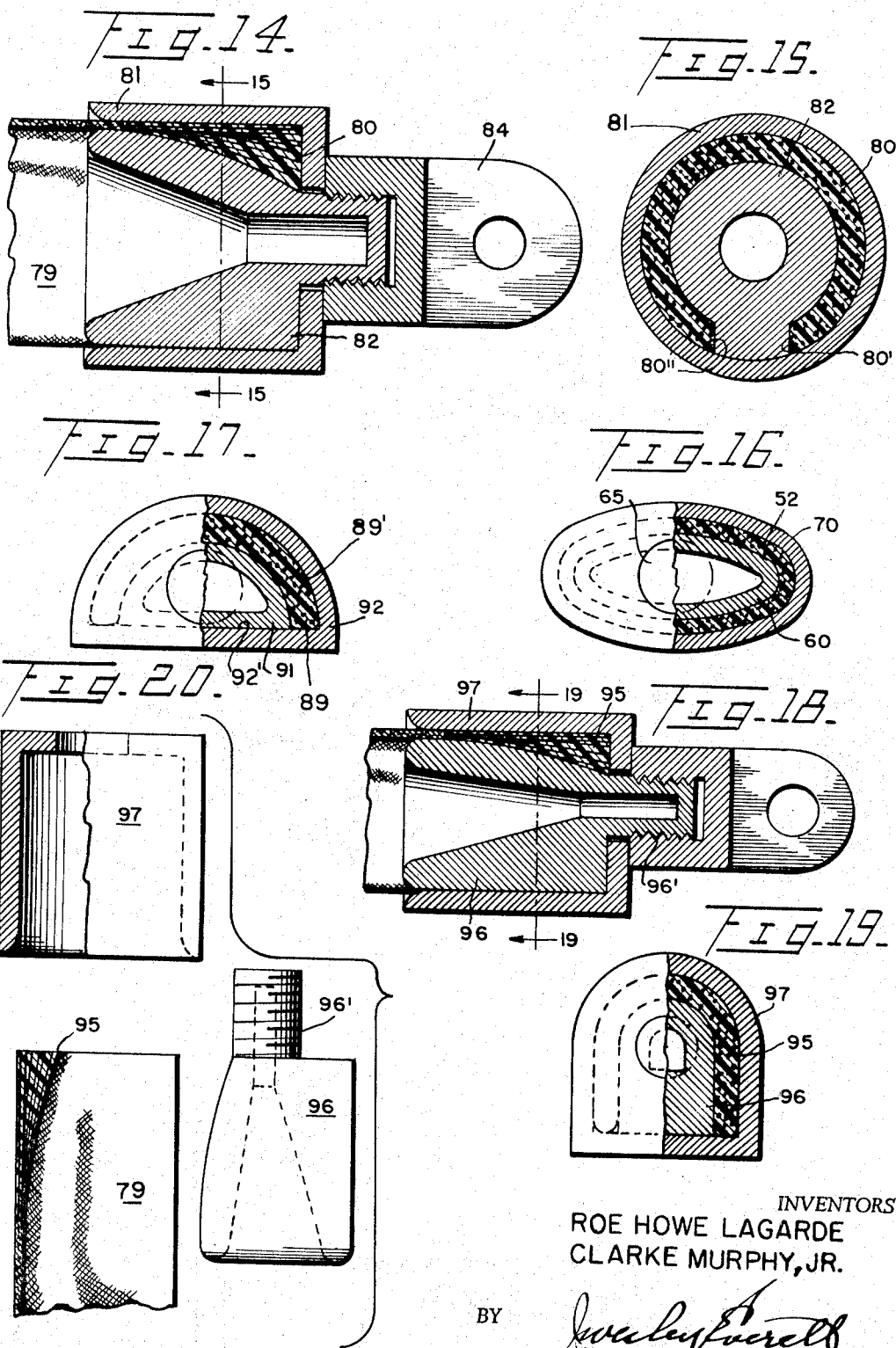
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BAND AND TAPE ANCHORING MEANS

Filed April 29, 1965

4 Sheets-Sheet 4



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BAND AND TAPE ANCHORING MEANS

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Filed Apr. 29, 1965, Ser. No. 451,736

14 Claims. (Cl. 24-265)

This invention relates to an improved securing means for fibrous materials in the form of flat, woven, flexible bands, tubular tapes, webbing, etc., and in particular to an end structure in combination with an improved fixture, and to the method of securing the ends of the fibrous material in the fixture.

Heretofore it has been found to be extremely difficult to secure the end of a flat band, or tubular tape, to a fixture against the possibility of release, or slippage, when the band, or tape, is subjected to a high degree of tensile strain, particularly if the same is constructed of synthetic fibrous material. While the present securing means is applicable to practically all sizes and types of bands and tapes, and for practically all kinds of uses, it is particularly effective for use on bands and tapes subjected to sudden shocks, such as, the application of a load when a parachute opens, or when a landing plane is arrested by cables having their ends attached to bands formed preferably of synthetic material for running out and retracting slack in these cables.

One object of the invention is to provide a lug made preferably from a solidifiable organic or inorganic plastic type material fixed to the end of the band, or tape, and adapted to engage a rigid fixture.

Another object of the invention is to form the lug with at least a part of one of its side surfaces with a diverging taper extending outwardly from the inner end thereof longitudinally of the axis of the band, or tape, and providing one of the fixture elements with a reversed tapered portion to engage the tapered surface of the lug.

Another object of the present invention is to provide a fixture adapted to engage the lug by the methods set forth herein, the holding effect between the end of the band, or tape, the lug, and the fixture being substantially the same as the tensile strength of the band, or tape, itself.

Another object of the invention is to provide a core element as a part of the fixture for increasing the holding effect of the fixture on the lug.

Another object of the invention is to provide a core element that may be easily and quickly attached to the lug.

Another object of the present invention is to form the lug on the end of a band, or tape, from which the major portion of the weft threads have been removed.

Another object of the invention is to provide an improved method in constructing the lug and the holding fixture for the same.

It is a further object of the invention to provide a filler which may be applied in liquid form, or a dry granular form, which will flow between the threads of the band, or tape, and completely fill the area of the lug forming means, and which will solidify and form together with the threads of the band, or tape, a substantially rigid lug member.

While several objects of the invention have been pointed out, other objects, uses and advantages will become more apparent as the nature of the invention is more fully disclosed; the same consists in the novel arrangement and forming of its several parts shown in the accompanying drawings forming a part of the specification, and in which:

FIGURE 1 is a horizontal view of the end of a band, or tape, including a lug formed on the end thereof and a lug-engaging fixture, shown partly in cross-section and

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partly in elevation, illustrating the position of the lug in the fixture.

FIGURE 2 is a sectional view taken on the line 2-2 of FIGURE 1.

FIGURE 3 is a sectional view taken on the line 3-3 of FIGURE 1.

FIGURE 4 is a sectional view of the end of the band, or tape, including the fixture and core taken on the line 4-4 of FIGURE 1.

FIGURE 5 is an enlarged fragmentary sectional view taken on the line 5-5 of FIGURE 1.

FIGURE 6 is a horizontal view partly in section and partly in elevation of a modified form of lug formed on the end of a tubular tape and a fixture attached thereto.

FIGURE 7 is a plan view looking from right to left in FIGURE 6 having parts broken away to show the core and the lug formed on the end of the tubular band.

FIGURE 8 is a sectional view taken on the line 8-8 of FIGURE 6.

FIGURE 9 is a view in elevation of one of the elements of the holding fixture illustrated in FIGURE 6.

FIGURE 10 is a horizontal view partly in section and partly in elevation of a further modified form of lug together with a modified form of the holding fixture.

FIGURE 11 is a plan view looking from right to left in FIGURE 10.

FIGURE 12 is a sectional view taken on the line 12-12 of FIGURE 10.

FIGURE 13 is a view in elevation of one of the elements as illustrated in FIGURE 10.

FIGURE 14 is a horizontal view partly in section and partly in elevation of still another form of lug and holding fixture.

FIGURES 15, 16 and 17 illustrate various cross-sectional forms the lug and fixture may take when taken substantially on the line 15-15 of FIGURE 14.

FIGURE 18 is a view similar to FIGURE 14, partly in section and partly in elevation, showing still a further modified form the lug and fixture may take.

FIGURE 19 is a view partly in section taken on the line 19-19, FIG. 18, and partly in elevation.

FIGURE 20 shows an exploded view of the several parts, partly in section and partly in elevation, of the form shown in FIGURE 18.

The band as shown in all the figures, except in FIGURES 6, 7 and 8, is of the flat woven type in the form of a band, or web, having longitudinal, or warp, threads and cross, or weft, threads; however, it is not intended that the invention be limited to this particular weave. Referring to FIGURES 1 to 5, band 12 is of the weft and warp woven type is adapted to be secured to a fixture in a particular way. In this form the weft strands are unlaid, or removed, from the end of the band for a predetermined distance and ending at a point 12'', as shown in FIGURE 2, leaving only the warp strands 20 about which is formed a lug 14 to be later described. The band adjacent the inner end of the unbraided strands is wrapped once about a core 13 and the two longitudinal edges 12' and 12'' of the band 12 are preferably secured by stitches 15. The core 13 is selected for size so that it will be of a circumference that will be exactly that of the width of the woven band when the band is wrapped about the core.

The lug-holding fixture comprises, along with the core 13, a rigid outer housing 16 preferably of substantially conical shape with each end extended in cylindrical form, as shown at 17 and 18, respectively, and with the inside configuration being tapered, the inside surfaces being preferably of convex form, as shown at 19, when taken on any plane through the center of the fixture. The smaller diameter of the fixture, which is substantially constant through the small end section 17, is approximately the same diameter as that of the core plus the thickness of the wrapped

woven band, while the larger diameter section 18 is considerably larger than the core plus the woven band allowing the warp ends of the unbraided end of the woven band to be spread or fanned outwardly from the elongated axis of the fixture. In this form of the invention, the un-
laid warp ends 20 of the band extend outwardly from the woven portion of the band for a distance not less than one-third the width of the band. The warp threads 20 are also placed in a divergent form about the core and within the confines of the inner diverging walls of the fixture element 16 and the outer surface of the core. The element 16 is preferably provided with a side wall surface in the area 17' parallel with the elongated axis of the tubular formed end of the band and the fixture in order to position the warp strands in the unwoven end portion in longitudinal alignment with the warp strands in the woven portion.

The lug forming material 27 is of organic or inorganic plastic which is introduced into the fixture around the warp threads 20 to form the lug on the end of the band, of the lug 14 may be first formed in a mold and then inserted into the fixture. Whether the lug is formed in the fixture, or in a mold, the overall results are substantially the same. The lug forming material adheres to the strands and fills the spaces between the strands and between the outer surface of the core 13 and the inner surface 19 of the fixture, or the mold cavity as the case may be. After solidification there is formed a substantially solid mass, the outer surface of which exactly fits the inside contour of the element 16. The lug has a predetermined amount of elasticity to allow a limited amount of adjustment under high pressures which will allow the lug to adjust itself to the warp threads 20 embedded therein and to any slight variations between the contours of the lug surface and the fixture cavity; of course, the lug is never of such elasticity as to allow it to change to any great degree and be withdrawn from the fixture when the band is under substantially high stresses. The inside contours of the surfaces of the lug and fixture are such that the pressure of the lug against the side of the fixture caused by a tensioning force on the band is resisted through the entire length of the fixture rather than at any one particular point or area. The convexed curve of the inner wall of the fixture absorbs the pressure throughout its entire surface, and the fixtures may be made more compact and of lighter material than heretofore when the fixture was made as wide as the band.

The core 13 as illustrated in this form is shown as of substantially cylindrical shape. However, it is not limited to this form, but may be tapered in either direction. The inner end 13' is preferably of semi-spherical form having the outer end preferably closed. The semi-spherical end 13' of the core prevents any possibility of a sharp edge coming into contact with the material of the band 12 during the assembling and use thereof when under extreme stresses. The outer housing is secured to a fixture holding element 29 by means of a threaded connection shown at 29'. The fixture holding element is provided with some convenient means, such as a hole 29'', through which may be inserted a bolt or clevis (not shown) for anchoring the fixture to a support. In this form, the core 13 and the element 16 are generally placed in position at the time the lug-forming material 27 is placed about the end of the warp strands of the band and may be attached to the holding element 29 later, or when the need be.

A modified form of the invention is shown in FIGURES 6 to 9. In this form the band is shown in the form of a woven fabric tube 30 in which the outer end 30' is shown as not unlaidd, the lug 32 being formed about the woven tube as shown best in FIGURE 6. In this modification, the lug 32 includes opposite outwardly and inwardly curved tapered surfaces 32' and 32''. Positioned on the inner side of the lug 32 is a tapered core 34 tapered inwardly from the inner end thereof as at 41 to coincide with the inner surface 32'' of the lug 32. The core 34

is constructed of a substantially rigid material and is inserted into the end of the woven tube 30 at the time the lug is formed. However, the core may be made in sections, as shown in FIGURE 8 at 34', 34'' and 34'''. If the core is made in sections, the lug may be molded separately and the core inserted later, after the lug has been formed. The core is provided with a thread 36 extending about its outer end which extends beyond the outer end of the lug for threadably receiving a holding element 38. The holding element is provided with a hole 39 for securing the holding element to a support. Extending about the outer tapered arcuated surface of the lug 32 is a clamping element 40. This clamping element is always made of a very strong and rigid material, such as, steel, aluminum, etc. and is preferably made in sections as shown best in FIGURE 9 at 40' and 40''. This clamping element is provided with an outwardly tapered surface 45 conforming to the contour of the outer surface 32' of the lug 32. The purpose of splitting the clamping element 40 is to also provide this element of the fixture with a structure that may be attached to the lug after the lug has been formed. In order that the sections 40' and 40'' may be held in position, there is provided a continuous ring 42 adapted to threadably engage the inner end of the clamping elements 40' and 40''. The inner circumference 42' of the ring is slightly greater than the circumference of the outer end of the lug 32 in order that the ring may be slipped over the end of the lug for assembling the clamping elements of the fixture after the lug has been formed. The outer end of the clamping elements 40' and 40'' may be secured in position by the holding element 38, such as, by the threads 44.

A further modified form of the invention is shown in FIGURES 10 to 13. This modification shows the fixture applied to a flat band 50 similar to the band shown in FIGURES 1 to 5 which is rolled adjacent its end to form substantially a circle and extend as a continuous body about the inner end of the core and is joined along its edges 50' and 50'' by stitches 50'''. In this form the weft threads adjacent the end of the band have been removed, or unlaidd, leaving only the warp threads 51, as described for the band 12 in FIGURES 1 to 5. This form is likewise provided with a gradual tapered circular lug 52 into which the warp strands 51 are imbedded. The lug 52 is provided with a gradual curved surface 53 extending inwardly along its inner surface as the surface extends outwardly between the inner end 51' of the unbraided portion and the outer end 52' of the lug. Adapted to engage the tapered inner surface 53 of the lug is a tapered core 60 having a tapered surface 60' of such configuration as to engage the tapered surface 53 of lug 52. The upper end of the core 60 is provided with a thread 61 and is adapted to threadably engage a holding element 65 having a hole 66 for securing the holding element to a support. Surrounding the lug 52 is a cylindrical retaining element 70. This retaining element 70 is to prevent the lug from spreading when the band and fixture are placed under strain. This retaining element may also be threadably connected with the holding element 65, if preferred, by a ring 72. In this form the lug may be molded with the core 60 in place and the remainder of the fixture may be assembled later to the lug and the core, or the lug may be formed separately without the core. If molded separately without the core, the lug and fixture are assembled as follows: the fixture is attached to the lug by first inserting the core 60 into the inner end of the lug and through the center opening of the circular hollow lug 52, as indicated by the arrow in FIGURE 10, after which the retaining element 70 of the fixture is placed over the top of the lug and the outer threaded end of the core. The holding element 65 is then screwed down on the core by means of the threads 67. Over the holding element 65 there is a ring element 72 abutted against the holding element 65 and threadably engaging the lug retaining element 70

by means of a thread 69. This form has the advantage of easy and quick assembly by having the outer surface of the lug 52 of uniform diameter and since the retaining element 70 also has a uniform diameter, it is easily slid over the outer surface of the lug. This also lends itself very readily to the separate formation of the lug and the fixture.

FIGURES 14, 17 and 19 illustrate the various cross-sectional forms the lug and fixture may take other than those already described. The previously described forms and the form shown in FIGURE 16 show the band completely surrounding the core. The cross-sectional form of the lug and fixture shown in FIGURE 14 is for the purpose of illustrating that the forms shown in FIGURES 1 to 13 are not necessarily of circular shape, but may be oval or any other desirable cross-sectional form. However, for certain purposes the band 79, or tape, may extend only part way around the core, as best shown in FIGURES 14, 15, 17 to 20. This form has the advantage, in that, the two separated lateral edges open up the warp on the core and take some of the strain off the edges of the band when the band is under tension.

FIGURES 14 and 15 show a lug 80 formed on the end of the band 79 in which the band does not extend completely around the core, as shown in FIGURE 15, wherein there is a space between the ends 80' and 80'' of the lug 80. The core 82 is in general substantially the same as the core 60 previously described in FIGURES 10 and 13. There is provided a lug retaining element 81 whose function is to prevent the lug from spreading when the band is under tension. There is also provided a fixture-holding element 84 adapted to be screwed upon the outer end of the core 82. In this form, however, the fixture is not provided with a ring element such as that shown at 72 in FIGURE 10.

FIGURES 17 to 20 have still further advantages, in that the arc of the lug for a given width band is such that the arc is not greater than approximately 180 degrees which allows the lug to have one full open side. The open side of the lug is such that the core may be inserted from the side of the lug. This form of lug and fixture uses a retaining element similar to the retaining element 70 used in the form shown in FIGURES 10 to 13 which allows the retaining element to be slid over the outer end of the lug.

FIGURES 17 to 20 show in detail two similar types of open side lugs and corresponding fixtures. In FIGURE 17 the lug 89 is of semi-circular form of 180 degrees, but may be of any desirable cross-sectional shape, in which the side opening is sufficient to place the core 91 laterally into the concave surface 89' of the lug 89. The outer retaining member 92 extends completely about the lug 89 and along the side 92' of the core not occupied by the lug.

In FIGURE 19 the lug is shown to be U-shaped in cross-section. The core 96 is similar to the core 91 shown in FIGURE 17, and the lug retaining element 97 is similar to the retaining element 92 shown in FIGURE 17. The upper end 96' of the core 96 is preferably threaded to receive a holding element similar to that shown for the core element 82 shown in FIGURE 14.

These open side lugs are quite desirable on bands for quick and easy assembly, as stated hereinbefore.

While the various shapes of cores have been illustrated as being connected to the holding elements by having a threaded extension, the extension may be eliminated and the core may be attached in any convenient way, such as by bolts, pins, slots, snaps, etc.

The lugs throughout the various modifications are all constructed of substantially the same type and for practical purposes are described as rigid. However, they have a built-in amount of predetermined elasticity, and are prone to a certain amount of change in form when subjected to high stresses and also to a limited springing

action when constructed in the open side form, shown particularly in FIGURES 17 and 20.

A longitudinal sectional view of the lug shows at least one of the lug surfaces having a concave tapered surface. However, while this is the preferred form, it is not intended that the lug be limited to this particular form, that is, the lug surface may also be a straight taper.

In cross-section the lug and fixture are shown in circular, semi-circular, and other arcuated forms; however, it is not intended that these elements be limited to these specific forms, as the end of the band may have configurations other than those shown and described, which will have substantially the same advantages. For example, the end of the band and lug attached thereto may in cross-section be in the form of a V wherein the core may be positioned between the adjacent surfaces of the lug, and the fixture will extend entirely around both the lug and the core. The lug may take other loop cross-sectional forms, such as, a quadrangle, a block-type U, or sinuous form, when these forms are capable of supporting at least part of the lug by a core, and would likewise be entirely surrounded by the fixture.

The invention above described provides an end securing means for bands and/or tapes wherein the width of the formed end of the band and lug is less than the width of the flat band. The fixture itself is not bulky, nor does it depend on a friction-held engagement between the fixture and the band. It provides a practical means for securing the end of the band which may be required to hold to the limit of the tensile strength of the band itself.

While the invention has been illustrated in several forms, it will be understood that various changes may be made in the detail arrangement and proportion of the parts without departing from the scope of the claims.

We claim:

1. An end securing means for a fibrous band, comprising:

(a) a substantially rigid hollow circular lug formed on the end of a tubular band, said lug having outwardly and inwardly tapered side wall surfaces extending toward the outer end thereof,

(b) a rigid fixture, including a hollow outer housing, for engaging said lug having an outwardly tapered side wall engaging the outwardly tapered outer side wall of the lug,

(c) a cylindrical core having a substantial portion of the core tapered inwardly toward the outer end thereof for engaging the tapered inner surface of the lug, and a portion extending outwardly beyond the tapered portion, and

means for engaging the extended portion of the core for attaching the fixture to a support.

2. In an end securing means for a fibrous band as claimed in claim 1 wherein the outer rigid housing is made in two or more sections.

3. In an end securing means for a fibrous band as claimed in claim 2 wherein a continuous ring is releasably extended over the inner end of the outer housing.

4. In an end securing means for a fibrous band as claimed in claim 1 wherein the core is made in two or more sections.

5. In an end securing means for a fibrous band as claimed in claim 1 wherein the means for attaching the fixture to a support is connected to the outer housing.

6. A method for securing the end of a fibrous band to a rigid fixture comprising:

(a) divesting the end of the band of its weft threads leaving the warp threads extending outwardly from the woven portion for a predetermined distance,

(b) rolling the band adjacent the end of the band from which the weft threads have been removed to form an arcuated portion,

(c) inserting one end of a core member into the arcuated portion of the band,

- (d) enclosing the core and warp strands with an outer housing of substantially the same length as the core having a diameter greater than the core forming an open area therebetween,
- (e) spreading the unattached warp strands evenly about the open area between the outer surface of the core and the inner surface of the outer housing,
- (f) filling the area between the core and the outer housing with a plastic filler material which when solidified will form a substantially solid mass about and between the warp strands and the area between the outer surface of the core and the inner surface of the outer housing of the fixture.
7. An end securing means for a fibrous band, comprising:
- (a) a substantially rigid lug of a solidified plastic material secured to the end of a band having substantially uniform lateral thickness and having at least a portion of the lug of arcuate form parallel with the longitudinal axis of the band and tapered inwardly in cross section toward the inner end of the lug;
- (b) a rigid fixture, including an outer housing, secured to the lug, said housing having an inner surface conforming to the outer surface of the lug;
- (c) a core element positioned within the outer housing having an outer surface conforming to the opposite surface of the lug;
- (d) means for attaching the fixture to a support; and,
- (e) at least the portion of the band positioned between the inner end of the outer housing and the inner end of the core being of tubular form with the edges of the band meeting about the core.
8. A device for securing the end of a flat synthetic, fibrous band, having a generally uniform thickness, onto a support, said device comprising:
- (a) a substantially rigid lug formed from solidified plastic material molded onto said end, said lug extending transversely across said band end and having an arcuate configuration which defines an inwardly facing lug surface and outwardly facing lug surface, said lug surfaces extending in a direction corresponding to the longitudinal axis of said band;
- (b) at least one of said surfaces being tapered away from said band to form an enlarged, outermost portion on said lug;
- (c) a rigid fixture element, including an outer housing, secured to said lug, said housing having an inner sur-

- face conforming to the outwardly facing surface of said lug;
- (d) a core element positioned within said housing and having an outer surface conforming to the inwardly facing surface of said lug; and,
- (e) means for attaching at least one of said elements onto said support.
9. An end securing means for a band according to claim 8 wherein the band is divested of its weft threads from the end on which the lug is formed to a distance substantially equal to at least one-third the width of the band.
10. An end securing fixture for bands according to claim 9 wherein the warp threads at the end free of the weft threads are diverted substantially evenly throughout the area between the outer surface of the core and the inner surface of the outer housing.
11. An end securing means for a band according to claim 10 wherein the lug comprises a solidified plastic composition which is applied in liquid or granular form and solidifies to form a substantially solid mass with the warp threads.
12. A device as defined in claim 8 wherein said inwardly facing surface is tapered.
13. A device as defined in claim 8 wherein said outwardly facing surface is tapered.
14. A device as defined in claim 13 wherein said inwardly facing surface is tapered.

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