Aug. 26, 1969 G. C. WILDI ET AL 3,463,202

WOVEN TAPES

Filed July 27, 1967 2 Sheets-Sheet 1

Fig.1.

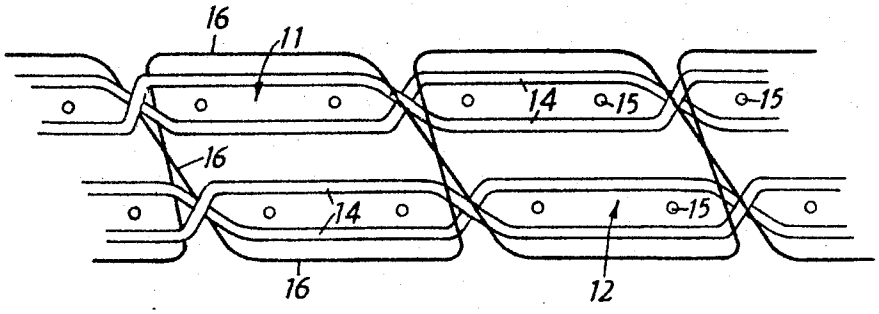


Fig.3.

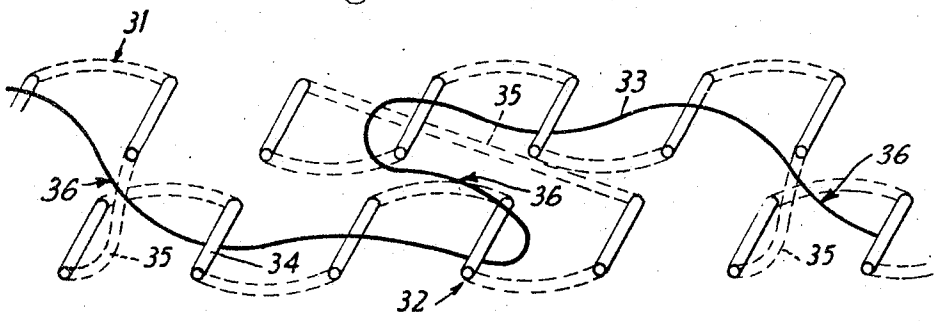
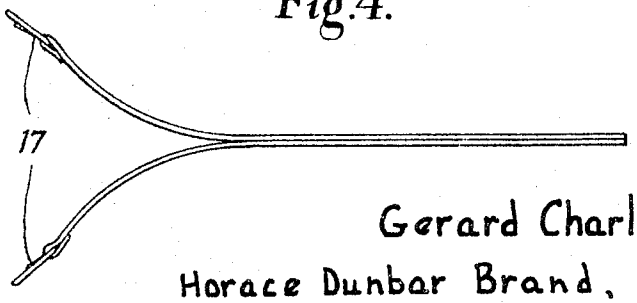


Fig.4.



Gerard Charles Wildi et al

Horace Dunbar Brand, inventors

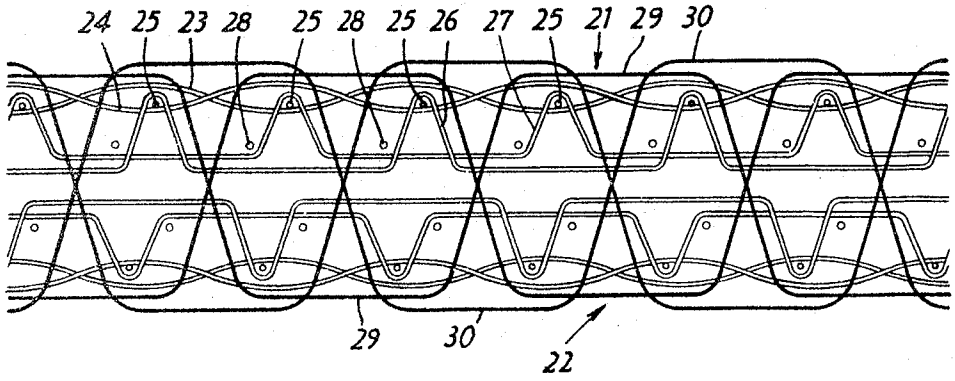
By, Wenderoth, Lind and Ponack, attorneys

Aug. 26, 1969 G. C. WILDI ET AL 3,463,202

WOVEN TAPES

Filed July 27, 1967 2 Sheets-Sheet 2

Fig.2.



Gerard Charles Wildi et al
Horace Dunbar Brand, inventors
By, Wenderoth, Lind and Ponack, Attorneys

United States Patent Office

3,463,202

Patented Aug. 26, 1969

3,463,202

WOVEN TAPES

Gerard C. Wildi, Hadlow Down, and Horace D. Brand, Selsdon, England, assignors to "W" Ribbons Limited, Croydon, Surrey, England, a British company

Filed July 27, 1967, Ser. No. 656,583
Claims priority, application Great Britain, July 27, 1966, 33,834/66
Int. Cl. D03d 25/00, 23/00
U.S. Cl. 139—383 10 Claims

ABSTRACT OF THE DISCLOSURE

A woven tape adapted for the absorption of energy comprises two webs, each of which is woven from warp yarns and weft yarns and which are secured together in face-to-face relationship by at least binding warp yarns which are woven into both of said webs. The yarns which secure the webs together can be broken by forces acting to separate the webs thereby to part the webs without destroying them and to absorb energy from said forces. The invention also provides an energy absorption device comprising a pair of attachment elements which are respectively attached to the two webs of such a tape at a region in the length of the tape where the two webs are not secured together.

This invention relates to woven tapes.

According to this invention there is provided a woven tape adapted for the absorption of energy comprising two webs each of which is woven from warp yarns and weft yarns and which are secured together in face-to-face relationship by at least binding warp yarns which are woven into both of said webs, the construction being such that the yarns which secure the webs together can be broken by forces acting to separate the webs, thereby to part the webs without destroying the webs and to absorb energy from said forces.

The invention also provides an energy absorption device comprising a pair of attachment elements, and a woven tape adapted for the absorption of energy comprising two webs each of which is woven from warp yarns and weft yarns and which are secured together in face-to-face relationship by at least binding warp yarns which are woven into both of said webs, the tape having in its length a region where the two webs are not secured together, one of the attachment elements being firmly secured to one of said webs in said region and the other of the attachment elements being secured to the other of said webs in said region and substantially opposite said one attachment element, and the construction being such that the yarns which secure the webs together can be broken by forces acting to separate the webs, thereby to part the webs without destroying the webs and to absorb energy from said forces.

Other objects of the invention and the advantages thereof will be appreciated from the following description of embodiments of the invention with reference to the accompanying enlarged diagrammatic drawings:

In the drawings.

FIGURE 1 is a section through a currently preferred tape of the invention,

FIGURE 2 is a similar section through another currently preferred tape of the invention,

FIGURE 3 is an enlarged perspective detail of a further tape of the invention but with the warp yarns omitted for clarity and with the exposed parts of the weft yarn shown in dotted lines, and

FIGURE 4 is an energy or shock absorber of the invention.

Referring now to FIGURE 1, the tape there shown comprises two separate webs **11** and **12** woven in a double twill pattern. Each web **11** and **12** comprises respectively warp yarns **14** and weft yarns **15** which do not cross over from one web to the other. The two webs **11** and **12** are bound close together by binder warp yarns **16**. The binder yarns **16** are arranged to encircle bundles of four picks, i.e. two adjacent picks in each web. The webs **11** and **12** may be parted as will be described hereinafter by breaking the binder warp yarns **16**. As the webs **11** and **12** are separate, they retain their identity after such parting.

Referring now to FIGURE 2, which like FIGURE 1 shows the spacing of the weft yarns in an exaggerated fashion, the tape again comprises two separate webs **21** and **22**. The webs **21** and **22** have respective warp and weft yarns which do not cross-over from one web to the other. The webs **21** and **22** are identical mirror images of each other and are each woven as offset tubular webs with the warp yarns arranged in four groups. In web **21**, the two warp yarns **23** and **24** cross alternately to bind each alternate pick **25** to form the upper or outer face of each web. The other warp yarns **26** and **27** alternately pass over these alternate picks **25**. The other pick **28** lies between the warp yarns **23** and **24** above and the warp yarns **26** and **27** below. The two webs **21** and **22** are bound close together by two sets of binder warp yarns **29** and **30**. The sets of binder warp yarns **29** change over on every fourth pick of each web (i.e. every eighth pick of the tape). The binder warp yarns **30** change over at similar spacings, the cross-over being offset by two picks of each web (i.e. by four picks of the tape) from the change-over of binder warp yarns **29**. Here again the webs **21** and **22** can be parted as will be described by breaking or tearing the binder warp yarns **29** and **30**. As the webs **21** and **22** are separate they retain their identity after such parting.

Referring now to FIGURE 3, which shows the wefts slightly shifted for clarity, the tape there shown comprises two separate webs **31** and **32** woven in a double twill pattern. Each web has, of course, individual warp yarns (not shown) and binder yarns **33** bind the two webs together. A common weft yarn **34** is provided for the two webs **31** and **32**. The weft yarn **34** is woven for at least three, but preferably as shown five, consecutive picks in each web before changing to the other web. The two webs **31** and **32** can be parted as will be described by breaking the binder warp yarns **33** and the weft yarn **34** at each change-over point (indicated diagrammatically at **35** and **36**). However as the two webs **31** and **32** are identifiably separate and as the change-over of the weft yarn takes place only after every fifth pick, the weft yarn remaining will nevertheless bind together the warp yarns so that the two webs retain their identity as separate webs as opposed to fraying away and disintegrating as would occur if the weft yarn was broken at the end of each pick.

In the FIGURES 1 and 3 embodiments, the warps and wefts are of 840/2 fold yarn. In FIGURE 2 embodiment, the warp yarns are again 840/2 fold yarn, two ends laid as one and the weft 840/3 yarn. The binder yarns for FIGURES 1 and 3 embodiments are conveniently 840 denier yarn whilst for the FIGURE 2 embodiment these are 830/2 fold yarn. There are conveniently one hundred and four warp yarns in the one and three sixteenths inch width of each web (i.e. a total of two hundred and eight warp yarns) and seventeen to eighteen picks to the inch in each web (i.e. a total of thirty-four to thirty-six picks to the inch throughout). The number of binder yarns required depend upon the required tearing or breaking strength of the tape but will normally be between fifteen to thirty percent and preferably between twenty and

twenty-five percent of the total number of warp yarns. In the present embodiments where a five hundred pound rated tearing or breaking strength is required, forty-six yarns are used, i.e. just over twenty-three percent of the total number of warp yarns. The yarns comprise conveniently nylon or other synthetic material yarn.

In use, and as shown in FIGURE 4, the two webs are parted over a portion of the length of the tape by tearing or cutting the binder yarns (not shown in FIGURE 4) together with the weft yarn at the change-over points **35**, **36** in the third embodiment. The two separated webs now have buckles or like connectors **17** attached thereto and these connectors are attached to two members that are to be moved apart under considerable force. When these two members are separated, they will exert a tearing force tending to tear the two webs apart. This tearing force will be met by the substantially constant resistance of the binder yarns and in the third embodiment the resistance to tearing of the weft yarn at the change-over points. Thus the tape will serve as a shock or energy absorber.

The tape serving as a shock absorber has a number of applications, especially in safety equipment and in the aircraft industry. Among other applications, the tape can be used in parachute harnesses to limit the initial stress on the parachutist when the parachute opens.

It will be appreciated that the length of webs parted initially will depend upon the use to which the tape is to be put. Similarly the strength of the webs, the number and denier of the warp and weft yarns and number and denier of binder yarns required as well as the weaving pattern also depends upon such use. The binder yarns may change over after any number of picks as desired although it is preferred to keep the change-over distance to a convenient minimum so that the "jump distance" (i.e. the distance where there will be no resistance to tearing apart of the webs) will be kept to a reasonable minimum to give a substantially constant tearing resistance.

We claim:

1. A woven tape adapted for the absorption of energy, comprising two webs, each of which is woven from warp yarns and weft yarns, and which are secured together in face-to-face relationship by at least binding warp yarns which are woven into both of said webs, the construction being such that the yarns which secure the webs together can be broken by forces acting against adjacent ends of said webs to separate the webs, thereby to at least partially part the webs without destroying the integrity thereof while absorbing energy from said forces.

2. A woven tape as claimed in claim **1** wherein the two webs are provided with respective separate weft yarns.

3. A woven tape as claimed in claim **1** wherein said binding warp yarns change from one web to the other after at least two picks of each web.

4. A woven tape as claimed in claim **1** wherein the two webs have a common weft yarn, at least three picks of the common weft yarn being woven consecutively in each web.

5. A woven tape as claimed in claim **4** wherein five picks of the common weft yarn are woven consecutively in each web.

6. A woven tape as claimed in claim **1** wherein the number of binder yarns is between fifteen and thirty percent of the total number of warp yarns.

7. A woven tape as claimed in claim **6** wherein the number of binder yarns is between twenty and twenty-five percent of the total number of warp yarns.

8. A woven tape as claimed in claim **1** having two sets of binder warp yarns crossing over at locations off-set from one another.

9. A woven tape as claimed in claim **1** in which both webs are woven as off-set tubular webs.

10. An energy absorption device comprising a pair of attachment elements, and a woven tape adapted for the absorption of energy comprising two webs, each of which is woven from warp yarns and weft yarns, and which are secured together in face-to-face relationship by at least binding warp yarns which are woven into both of said webs, the tape having in its length a region where the two webs are not secured together, one of the attachment elements being firmly secured to one of said webs in said region and the other of the attachment elements being secured to the other of said webs in said region and substantially opposite said one attachment element, and the construction being such that the yarns which secure the webs together can be broken by forces acting to separate the webs, thereby to at least partially part the webs without destroying the integrity thereof while absorbing energy from said forces.

References Cited

UNITED STATES PATENTS

2,471,166	5/1949	Neff	139—383
3,032,072	5/1962	Weiner et al.	139—383
3,045,711	7/1962	Gibbons	139—408
3,283,389	11/1966	Nisbet	139—383

FOREIGN PATENTS

783,330	4/1934	France.

HENRY S. JAUDON, Primary Examiner

U.S. Cl. X.R.

139—408