(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 247 869**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **87304719.5**

(22) Date of filing: **28.05.87**

(51) Int. Cl.[4]: **B 65 D 63/10**
B 66 C 1/18

(30) Priority: **29.05.86 FI 862286**

(43) Date of publication of application:
02.12.87 Bulletin 87/49

(84) Designated Contracting States:
BE DE ES FR GB NL SE

(71) Applicant: **LASSILA & TIKANOJA OY**
Urusvuorenkatu 2 P.O. Box 670
SF-20361 Turku 36 (FI)

(72) Inventor: **Kiema, Timo Mikael**
Raskinpolku 8 A
SF-20350 Turku (FI)

Kiema, Mikko
Jousitarha 4
SF-20380 Turku (FI)

(74) Representative: **Calderbank, Thomas Roger et al**
MEWBURN ELLIS & CO. 2/3 Cursitor Street
London EC4A 1BQ (GB)

(54) **A load-handling band and a method for producing the same.**

(57) The invention relates to a strong load-handling band, such as a multi-lift band, double-lift band and a load-strapping band, its supporting part being a core made up of numerous reinforcing plastic films of the same width as the band. The films are laminated one on top of the other, in which case they remain parallel during the handling of the load. The bands can also be encircled with a plastic protective mantle of one or several layers.

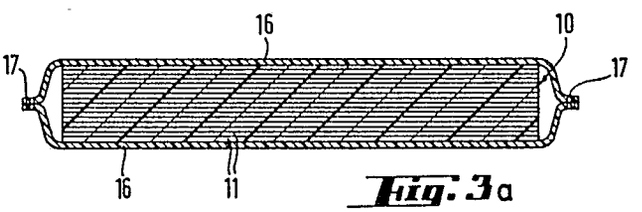

Fig. 3a

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Description

A load-handling band and a method for producing the same

The present invention relates to a band intended for lifting and strapping a load, the supporting part of the band being a core made up of numerous longitudinal elements, and to methods for producing such a band.

A usable load-handling band is required to be strong, to retain its shape, and to withstand especially well the local mechanical stresses caused by hoists and the load. Load-handling bands have traditionally been produced by weaving. Such a band is very tough and strong, but in general a woven structure is expensive for one-way use. Bands made of compact plastic are less expensive, but they are not as tough, resistant to wear or flexible as are woven products.

There are also in use bands which have a core made up of a coil of longitudinal threads and a mantle which protects the core. DE Lay-Open Print 2 355 548 discloses bands of this type, in which the longitudinal threads and the mantle are of a synthetic material resembling plastic. The separate threads or monofilaments of such relatively inexpensive bands will with time become disordered; the band will deform and be therefore subjected to local mechanical stresses. If the strings or monofilaments are bonded together as in DE Lay-Open Print 2 847 563 or US Patent 4 130 686, the flexibility of these longitudinal elements is eliminated and the band becomes too stiff.

Thus far there have not been invented load-handling bands which would be easy to manufacture and would at the same time be strong, retain their shape and withstand well the local mechanical stresses caused by the hoist and the load. The object of the present invention is to provide a load-handling band which has these good properties. The invention is thus mainly characterized in that the longitudinal elements are long plastic films which have substantially the same width as the band, are laminated one on top of the other, and thus form the core of the band.

The reinforcing films of the load-handling bands according to the invention can be produced by conventional technology by extrusion (sheet extrusion or sheet blowing technique) from polypropene, polyethene, polyamide, polyester or some other similar polymer or copolymer, or mixtures of the same, which can be worked into a continuous film. The polyolefins polypropene and polyethene are especially suitable raw materials for the manufacture of bands according to the present invention, since they are less expensive than, for example, polyamide or polyester, which are suitable mainly for special purposes. The films can advantageously be oriented monoaxially by stretching them in the longitudinal direction, whereby they are considerably strengthened. Since the films are thin, the degree of orientation of their molecules rises much higher than the degree of orientation of a compact band, and thus their tensile strength becomes very high. Polypropene and polyethene have good ability to crystallize, good heat-sealability, and they can well be reinforced by monoaxial orientation. The tensile strength of the film must be at minimum 400, preferably 500 N/mm^2 (raw-material-specifically 5.5-6.5 cN/dtex). Otherwise the film will stretch in the lifting and strapping situation. Reinforcing the band by greatly increasing the number of films will, on the other hand, be too expensive. The most advantageous film thickness is about 0.03-0.05 mm.

When manufacturing products according to the invention, various film materials and various directions and degrees of orientation can be laminated optimally in order to produce a load-handling band according to the present invention. It is preferable that, for example, the inner layers of the band have a high tensile strength and the surface layers have a high abrasion strength and bursting strength. For this purpose, appropriate commercial polyolefin types are available. Multiple-layer films can also be used.

The structures of the load-handling bands according to the present invention, made from the above-mentioned reinforcing film, are derived from a basic unit which is a band laminated, in multiple layers, from films. The number of film layers is more than 10, preferably more than 20, and most preferably 20-80. Fewer than 20 film layers is not recommended, unless the ends of the film are firmly secured. The width of the film may vary greatly, depending on its intended use.

A simple band structure which has been produced by merely laminating plastic films having the width of the band, the films being detached in relation to one another, can be used only to a very limited extent for handling a load. Some applications are obtained for such a band when the layers are one on top of the other in coil form and the ends of each individual film are secured. The efficiency of a multi-lift sling thus produced is up to 80-95 %, depending on the number of the layers.

From the basic structure described above it is possible very simply to produce more advantageous structures suitable for one-way type load-handling bands. The principle is that the individual film layers are kept together so that, for example, the hoisting hook or the edges of the load cannot get between the layers. This can be done by encircling the band with a protective film wider than the band, the edges of the film being then-heat sealed or bonded together using adhesive, to form a mantle which keeps the layers together and protects them. A protective layer suitable for a mantle can be of any heat-sealable (also other plastic welding methods can be used) or bondable (for example, hot-melt bonding) plastic or elastomer. Individual film layers can also be kept together by bonding or heat-sealing together the edges of all of the individual films, or by bonding the individual band films together over their entire area by using a suitable adhesive.

Band structures suitable for multi-use can be obtained advantageously by coating a strong basic

film-band structure with several protective film layers. In this case the protective film layers can be marked in order to determine the critical degree of wear. A basic band structure coated with a polymer melt is also suitable for multi-use. The material used for such melt coating depends, of course, on the material of the basic structure. Thus the polypropene basic structure can be advantageously coated with a lower-melting polyethene, ethene-vinyl acetate copolymer, softened polyvinyl chloride, or in some cases also with polyurethane. Elastomers can also be used for the coating.

Band structures according to the present invention can also be combinations of the structures mentioned above.

Product types of the load-handling bands to be manufactured from multiple-layer film band include multi- and double-lift slings (endless band) and load-strapping band (continuous band). In a double-lift sling the joining of the loop in the middle can be accomplished by, for example, transverse lashing of the film band. If it is desired to produce a load-strapping band with a loop (a hook or a loop iron is fixed to the loop), the closed metal ends of the strapping devices can be passed into the loop formed in the band as early as the winding stage. Since producing, with a high efficiency, a joint for the loop in woven band structures is difficult, in this endless structure of a band formed from films laminated one on top of the other the efficiency of the joint of a loop is higher than that of a stitched joint in a woven band. In load- strapping bands, a friction joint between the film layers provides a high holding capacity in strapping locks.

The present invention also relates to a method for the manufacture of load-handling bands. The invention is thus also characterized in that an endless band is produced by winding a reinforcing plastic film onto one or several rotating drums, until a sufficient number of reinforcing film layers have been formed in the web around the drums, whereafter the last film layer is cut off and its ends are possibly secured. The length of the web encircling the drum or drums, i.e. of the endless band being produced, can be regulated by respectively adjusting the distances between the drums or the circumferential length of the drum. A continuous band can be produced by winding a reinforcing band, having the width of one or several bands, simultaneously from several rolls of film onto the same web, by cutting at the end of the web track the laminated films having the width of several bands into bands of the desired width, and by coiling the bands into continuous bands of the desired length.

According to one preferred embodiment of the invention, first one or several layers of a protective film wider than the reinforcing film are wound, whereafter the reinforcing film layers are wound, and finally again one or several layers of the wider protective film, whereafter the protective-film edges extending beyond the reinforcing film are heat-sealed together to form a mantle to protect the core formed by the reinforcing films. When an endless band is being produced, these steps take place in succession, and when a continuous band is being produced, the steps take place simultaneously.

The cutting of the film into band width can be done either before or after the winding. It is also possible to produce the band by cutting the reinforcing film layers before the winding and by cutting the protective film layer, wound at the beginning and at the end, after the winding. In this case the original wide roll of reinforcing film is cut into rolls having the width of the band, and the rolls are shifted on the shaft to suitable distances from one another, or they are cut and separated only at the winding stage. The winding starts by first winding from the protective film roll onto the drum/drums one or several layers of an uninterrupted protective film having a width somewhat greater than the total combined with of the bands to be wound. Then the precut reinforcing films are wound onto the protective films. When a sufficient number of reinforcing film layers have been wound, one or several layers of an uncut protective film is wound on top of them.

At this stage it is possible to apply streaks of adhesive onto the protective films, the adhesive streaks running longitudinally between the bands and outside the bands situated outermost. Finally the protective films are pressed together and cut, which is done by cold cutting when the intention is to bond the protective layers together with an adhesive, or hot cutting when adhesive is not used and the intention is to heat-seal the protective films together.

The above-mentioned method for producing the film can also be carried out by replacing the protective films in part or entirely by a reinforcing film, whereby the mechanical properties of the band obtained are changed.

When a film strap bonded with an adhesive all over its area, or a structure bonded with adhesive or welded only at the edges, is being made, the procedure can be that a strong wide film is wound by a double-drum or a single-drum method, the applying of the adhesive taking place during the winding step, and finally the straps are cut out of the wide film by cold cutting (films bonded with an adhesive) or by hot cutting (bonding and cutting simultaneously).

When the intention is to coat the strap by melt coating, by spraying or by the immersion method, a double-drum winding system is to be used for practical reasons.

A continuous, so-called load-strapping band can, for example, be reinforced by winding a reinforcing film, having the width of one or several bands, simultaneously from several rolls of film onto the same web, by cutting at the end of the web track the laminated layers having the width of several bands into bands of the desired width, and by coiling the bands into continuous load-handling bands. The bonding and cutting, or the hot cutting, is carried out in the same manner as above.

The invention is described below with the aid of preferred embodiments of the load-handling bands and their production methods, with reference to the accompanying drawings, in which

Figure 1 is a cross sectional representation of the basic structure of the band,

Figure 2 depicts a side view of a multi-lift sling,

Figures 3a)-e) are cross sectional representations of one-way type load-handling bands,

Figures 4a)-c) are cross sectional representations of multi-lift type load-handling slings,

Figure 5a)-c) depicts product types manufactured from load-handling bands according to the invention,

Figures 6a)-b) depict two winding units for an endless film band.

All of the load-handling bands according to the present invention are based on the basic band structure 10 depicted in Figure 1. In the multi-lift sling 12 according to Figure 2, made from film 11, only the ends 13, 14 of the wound film 11 are secured by 15, in which case the efficiency of the joint is 80-95 %, depending on the number of the film layers 11.

The one-way load-handling bands of Figure 3 have been obtained by combining film elements of the basic structure of Figure 1. The films 11 are encircled by a protective film 16 wider than they themselves, which protective film has been heat-sealed or bonded around the basic band structure 10 by using one Fig 3b) or two Fig 3a) joints 17. Figure 3c) depicts a structure in which the films 11 of the basic structure 10 have been bonded together with an adhesive only at their edge portion 18. Fig 3d) depicts a structure in which the films 11 of the basic structure 10 have been bonded together with an adhesive all over their area 19, and Fig 3e) depicts a structure in which the edge portions 20 of the films 11 of the basic structure 10 have been welded together.

Figure 4 depicts band structures which are usable primarily for multi-lift use. Figure 4a) depicts a melt-coated band structure which has been melt-coated with a material 21 having a melting point lower than that of the material of the basic band structure 10. Figure 4b) depicts a band in which the basic band structure 10 is protected by more than one protective film layer 22. Figure 4c) depicts a band in which the protective film is a reinforcing film 23 which is, for example 5-10-fold, (not shown) in which case a good buffering effect is obtained in lifting a load.

Figure 5 presents preferred product types of the load-handling band according to the invention. Figure 5a) depicts a multi-lift sling 24 made from an endless band. Figure 5b) depicts a double-lift sling 25 made from an endless band, in which the loop has been joined in the middle by transverse lashing of the band. Figure 5c) depicts a continuous band 26 intended for strapping a load.

Figure 6 depicts a preferred production method for load-handling band according to the invention. In Figure 6a) the reinforcing film 11 is wound from a roll 1 onto two drums, 2 and 3, to reinforce the endless load-handling band. When a sufficient number of layers have been wound one on top of the other, the film 11 is cut off and its ends are secured. The length of the produced endless band can be set in advance by adjusting the distance between the drums, by moving one drum (3) to different positions (3a and 3b). In Figure 6b) the reinforcing film 11 is wound from roll 1 onto one drum 4 the circumferential length of which can be adjusted.

Claims

1. A band intended for the lifting and strapping of a load, the supporting part of the band being a core made up of numerous parallel plastic film bands laminated one on top of the other, **characterized in** that the said core is encircled by a protective film mantle of plastic or elastomer.

2. A band according to Claim 1, **characterized in** that the number of plastic film layers one on top of the other is at minimum 20, preferably 20-80.

3. A band according to Claim 1 or 2, **characterized in** that the reinforcing plastic films are of a plastic suitable for film raw material, preferably polyolefin, most preferably polypropene, polyethene, or their copolymers or derivatives.

4. A band according to any of the above claims, **characterized in** that the reinforcing plastic films are oriented in the longitudinal direction.

5. A band according to any of the above claims, **characterized in** that the protective film mantle is made up of one or two parts heat-sealed or bonded together, the parts having one or several protective film layers.

6. A band according to any of the above claims, **characterized in** that the reinforcing plastic films are bonded together with an adhesive either at their edges or all over their area.

7. A band according to any of the above claims, **characterized in** that the core made up of the reinforcing film layers is coated with a melt of a polymer the softening point of which is lower than the softening point of the material of the reinforcing film layers.

8. A multi- or double-lift sling, **characterized in** that it is made of an endless band according to any of the above claims.

9. A load-strapping band, **characterized in** that it is made of a continuous band according to any of Claims 1-7.

10. A method for producing a band intended for lifting and strapping a load, in which method a reinforcing plastic film band is wound to form a multiple-layer endless band, **characterized in** that in connection with this winding the multiple-layer endless band is encircled with a plastic or elastomer mantle.

11. A method according to Claim 10, **characterized in** that the mantle is prepared by winding first one or several layers of a protective film band wider than the reinforcing plastic film band onto one or several drums, whereafter numerous layers of a reinforcing plastic film band is wound onto the same drum or the same

drums, and finally again one or several layers of the wider protective film band are wound, whereafter the protective film edges extending beyond the reinforcing film are heat-sealed or bonded together using an adhesive to form a mantle protecting the core made up of the reinforcing films.

12. A method according to Claim 11, **characterized in** that the length of the endless band or sling is set by adjusting the distance between the several drums or by changing the circumferential length of the only drum.

13. A method according to any of Claims 10-12, **characterized in** that, in connection with the winding, adhesive is applied to the edges of the reinforcing plastic films or over their entire surface in order to bond them together.

14. A method according to Claim 10, **characterized in** that the mantle is made by coating a band, wound from a reinforcing band, with a polymer melt, by melt coating, by spraying or by the immersion technique, preferably in such a way that the coating is carried out directly in connection with the double-drum winding.

Fig. 1

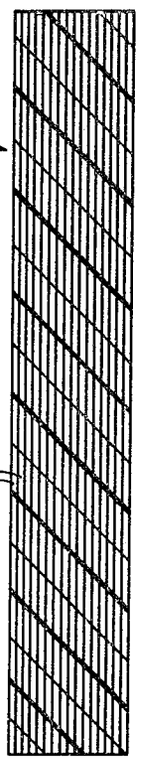
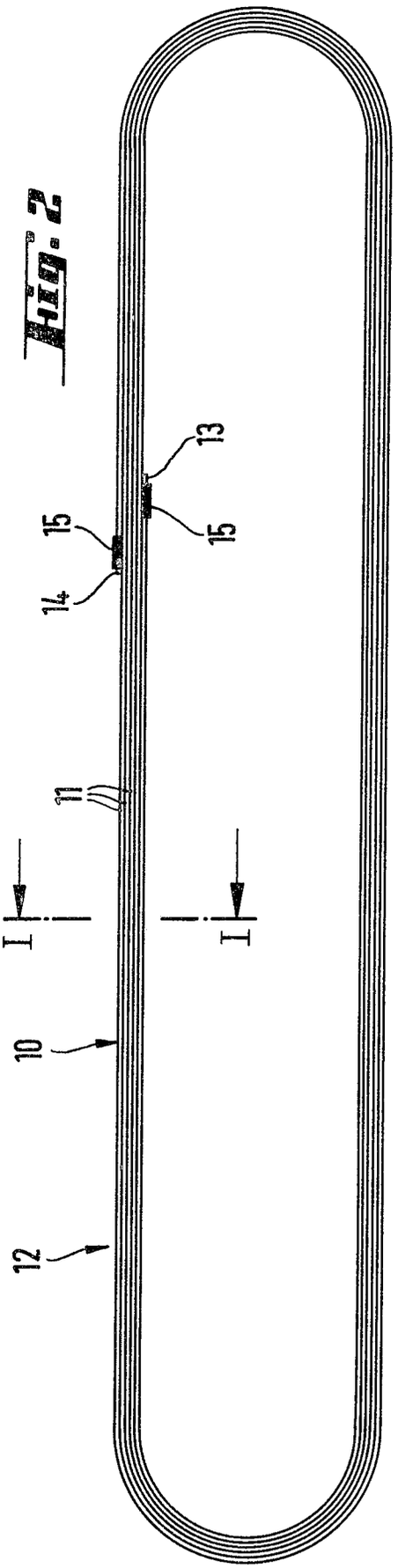


Fig. 2



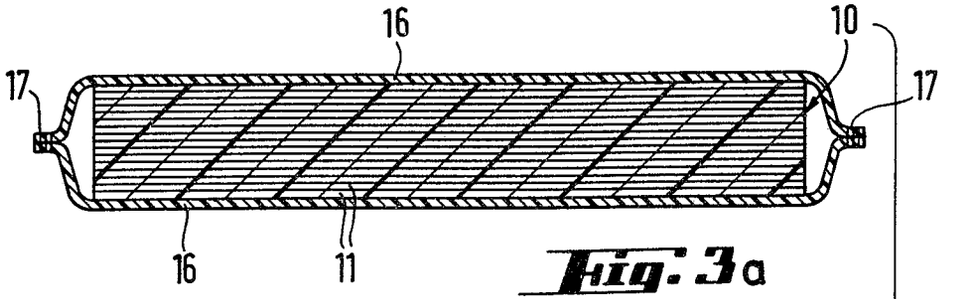


Fig. 3a

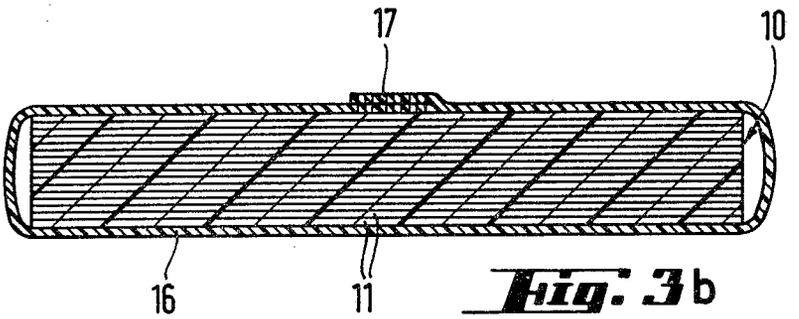


Fig. 3b

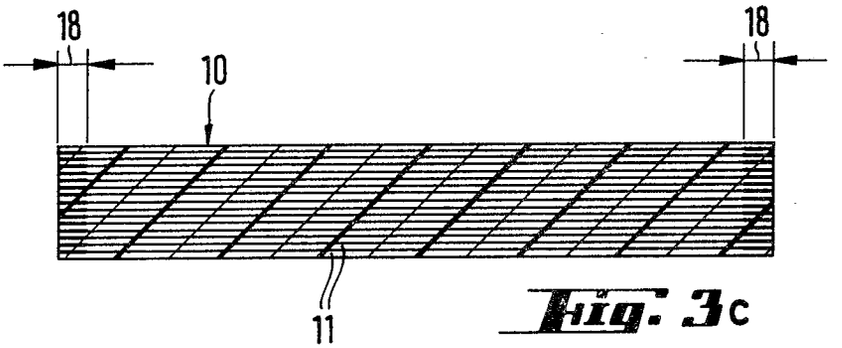


Fig. 3c

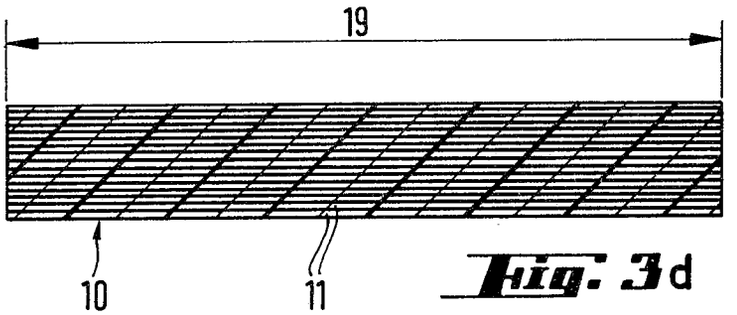


Fig. 3d

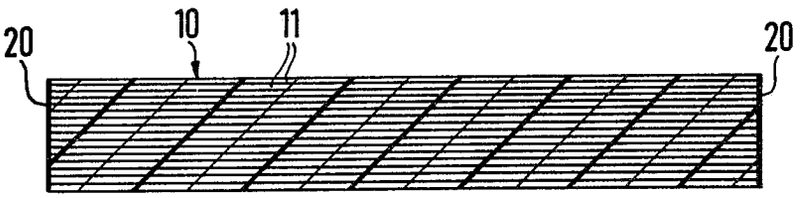


Fig. 3e

Fig. 3

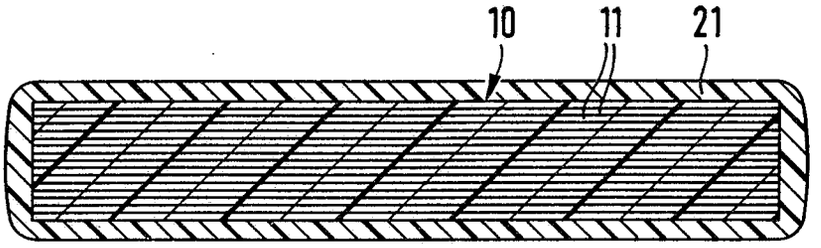


Fig. 4a

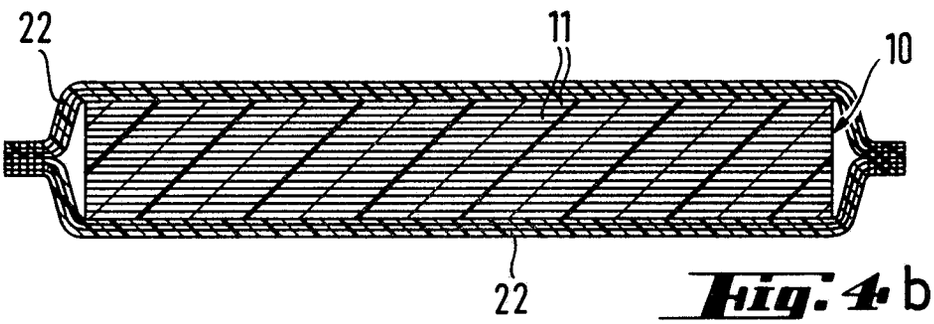


Fig. 4b

Fig. 4

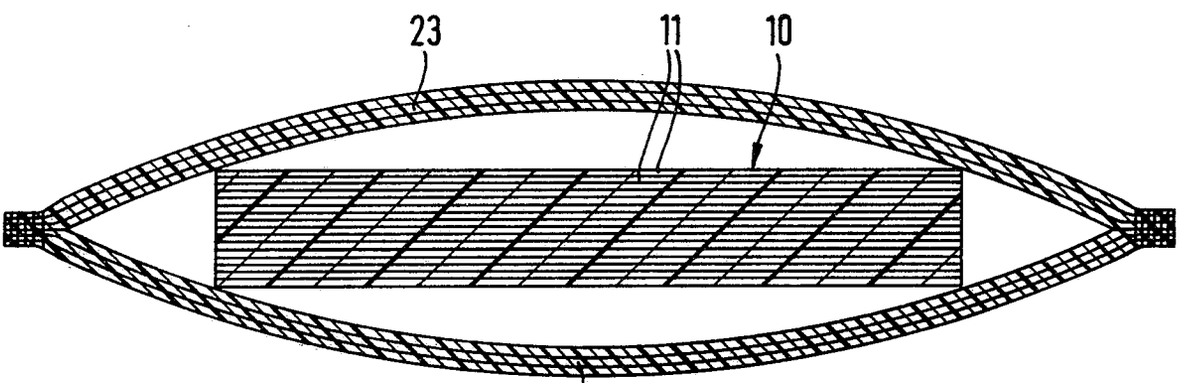


Fig. 4c

Fig. 5

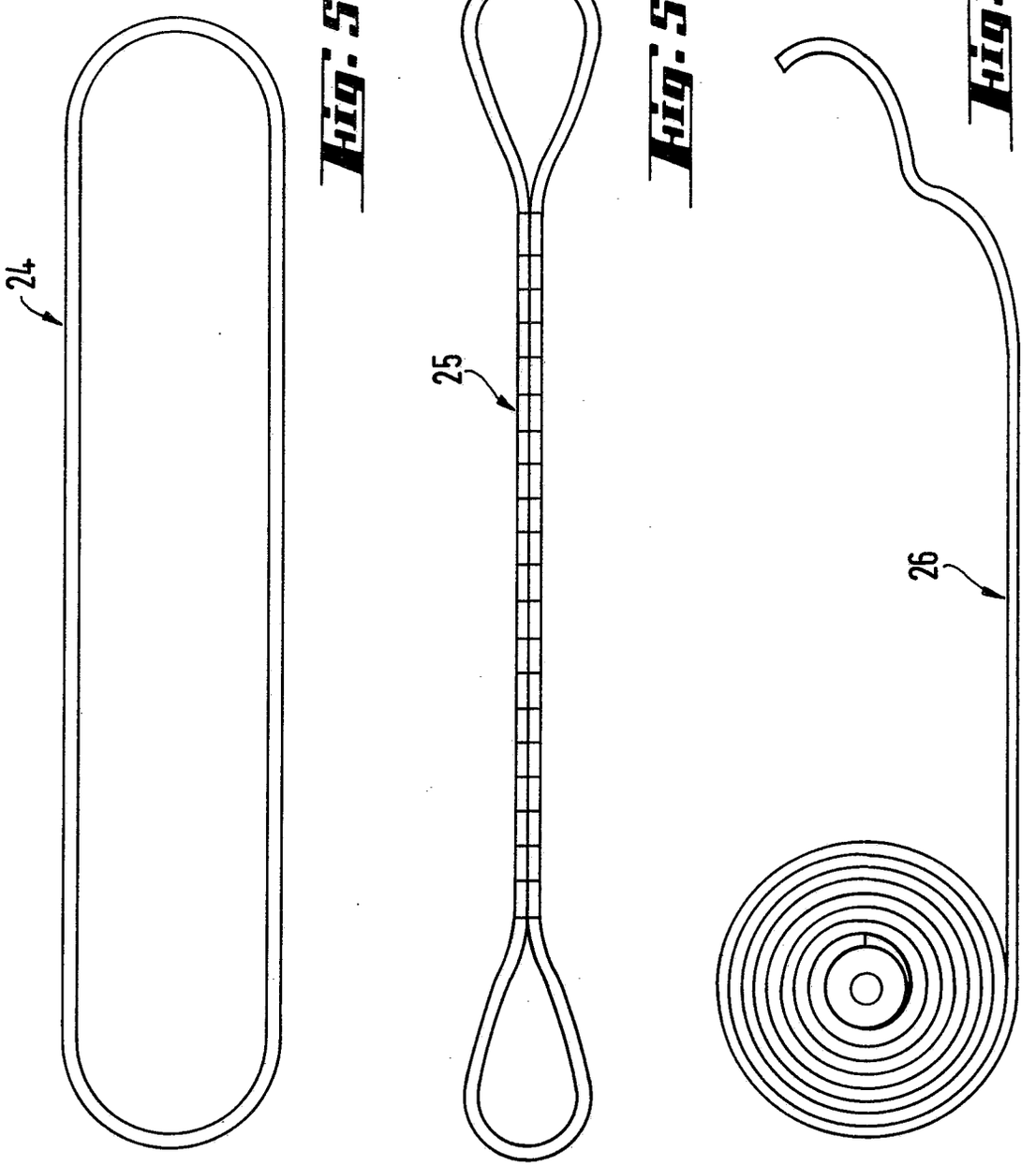


Fig. 5a

Fig. 5b

Fig. 5c

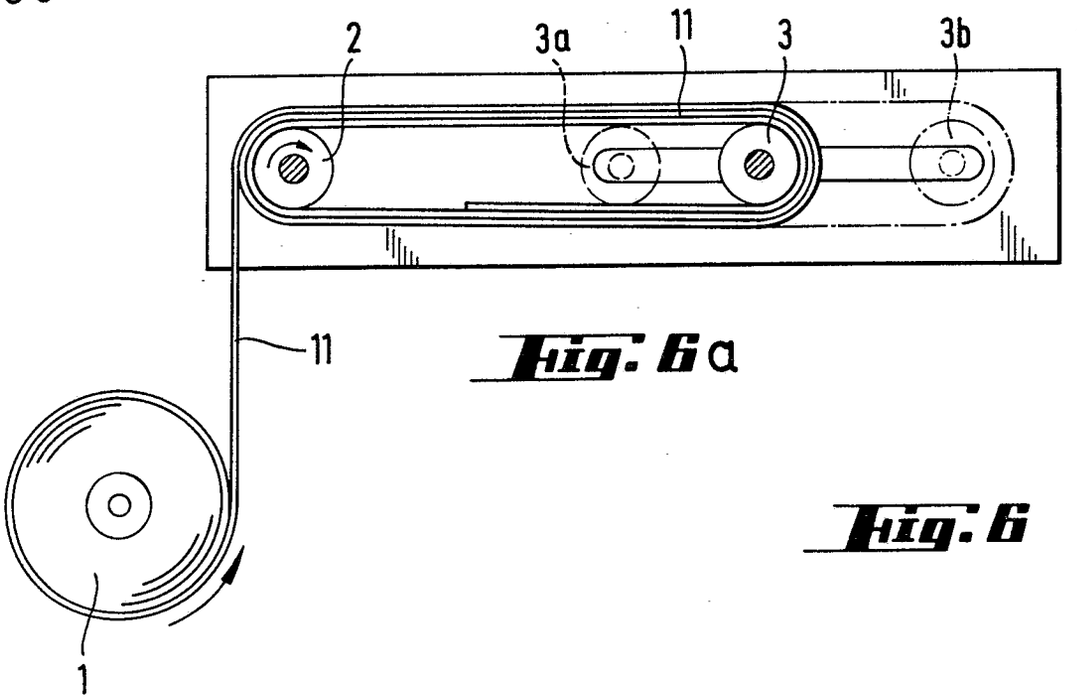


Fig. 6a

Fig. 6

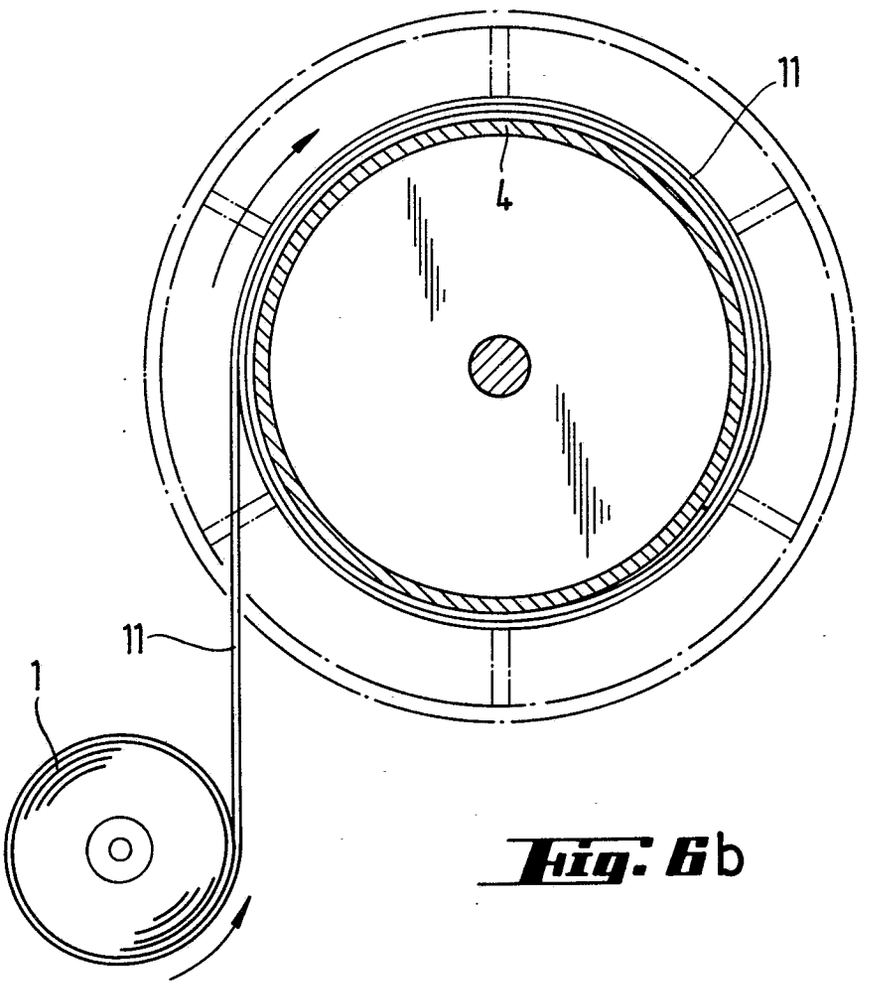


Fig. 6b