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(54) **LACE TENSIONING SYSTEM**
SCHNÜRVERSCHLUSSSYSTEM
SYSTEME DE TENSIONNEMENT DE LACET

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(56) References cited:
WO-A-97/28713 **DE-C- 33 530**
DE-C- 641 539 **FR-A- 1 550 608**
GB-A- 2 278 533 **US-A- 5 029 371**

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Description

[0001] This invention concerns lace tensioning systems suitable for footwear, clothing and other applications.

[0002] The lace tensioning system currently used for footwear generally comprises a pair of spaced flaps having eyelets in and/or hooks thereon through or around which a lace is threaded leaving its ends free. The ends of the lace are pulled to draw the flaps towards each other to a required extent and then tied in a knot. This system has a number of drawbacks. Firstly, the eyelets or hooks have to be individually inserted during manufacture, which is time consuming and hence keeps costs up.

[0003] Secondly, the lace has to follow sharp curves around the eyelets or hooks which causes wear of the lace and increases the friction forces to be overcome in tensioning or loosening the lace.

[0004] Thirdly as the lace in part passes under the flaps which hold the eyelets, tightening of the lace also increases the pressure on the lace parts under the flaps and hence the friction forces to be overcome in tightening the lace. This is a particular problem for long lace systems in boots, where it is necessary to pull a lace tight in stages starting from the bottom using one hand to stop the lace loosening and the other to progressively tension the lace. This is a fiddly and time consuming process. The friction in the system also makes it more difficult to obtain an even tension throughout. With cold fingers the process of fastening boot laces is even more difficult.

[0005] Fourthly, it is necessary to tie a knot or bow in the lace ends to secure the lace tightly. Unfortunately, knots and bows tend to undo or can be undone by being snagged on something. It is then necessary to stop and retie the lace. This is especially difficult with cold fingers and small children usually require the assistance of an adult.

[0006] My earlier Patent Application No. WO97/28713 discloses the features of the preamble of claims 1 and 2 and describes a lace tensioning system comprising a pair of flaps arranged with facing edges, teeth on opposite edges of the flaps, the teeth on one flap being out of phase with the teeth on the other flap, each tooth having an opening therethrough, and a lace secured at one end and being threaded alternately through the teeth of one flap then the other, whereby tensioning of the lace draws the teeth and hence the flaps towards each other.

[0007] However, a loop of lace results, which can be dangerous if left free, especially when used on footwear, because it can snag on objects and cause a wearer to trip up.

[0008] An object of this invention is to provide an improved lace tensioning system.

[0009] According to one aspect of this invention there is provided a lace tensioning system comprising a plu-

ality of teeth on an edge of a flap, each tooth having a first opening therethrough and a lace threaded through the teeth alternately with an article to which the lace tensioning system is to be connected, whereby tensioning of the lace draws the teeth and the article towards each other, means on the lace for taking up slack in the lace comprising a peg or the like on the lace, which peg is locatable in a selectable component of the system.

[0010] According to another aspect of this invention there is provided a lace tensioning system comprising a plurality of teeth on an edge of a flap, each tooth having a first opening therethrough and a lace threaded through the teeth alternately with an article to which the lace tensioning system is to be connected, whereby tensioning of the lace draws the teeth and the article towards each other, the teeth each having a second hole at right angles to the plane of the flap, whereby the lace is being provided with means for taking up slack in the lace comprising a peg or the like on the lace, the second hole receiving the peg or the like on the lace.

[0011] The term "lace" as used herein is intended to include not only laces but also other suitable flexible elongate means, such as cord, string or elasticated cord.

[0012] The article to which the system of the invention is connected may be a frame member but will preferably be another set of teeth on an opposing flap.

[0013] The lace may have free ends that are enlarged in some way, such as by knotting, to prevent them being pulled through end teeth. Alternatively, the lace may be continuous, such as by having its ends joined, say by knotting together. When a peg member is provided on the lace, it may be convenient for any knot to be contained therein.

[0014] In preferred embodiments one or more locking means may be provided on the lace to take up slack in the lace. In one preferred embodiment, such locking means are provided intermediate the ends of the lace. On long lace systems more than one locking means are preferably used in order to provide rapid even tensioning and untensioning over the whole length of the lace. In an alternative preferred embodiment of the invention, such locking means is associated with a tooth of the lace tensioning system. Preferably a tooth has wedging means pivotally arranged on the tooth, whereby the wedging means can be moved so as to trap the lace between itself and a part of the tooth over which the lace passes. The wedging means may have a profiled gripping surface.

[0015] The preferred locking means has a body through which a loop of the lace passes and means associated with the body to lock the loop to the body. Preferably said means comprises a wedge member movable in the body and between the sides of the loop between a first position where the loop is free to move and a second position where the wedge traps the sides of the loop against the inside of the body.

[0016] The peg may be on a loop of the lace or on a

free end thereof. In one preferred form, the peg may be on a loop of the lace created by the locking means. The peg preferably locates in a selected tooth of the lace tensioning system. The teeth preferably have holes therein to receive a part of the peg. Preferably that part of the peg is resiliently deformable, whereby it is compressed to enter a hole of a tooth and retained by expansion. Additionally or alternatively, that part of the peg and the holes of the teeth may have mutually engaging formations. For example, the holes may have constrictions that engage a slot or the like of that part of the peg.

[0017] The teeth may be secured to the flaps in any suitable way. Conveniently, the flaps may be provided with thickened edges and the teeth may have slots shaped to be retained on said thickened edges, for example, by having a narrower lead-in part and a wider end part within which the thickened edge of a flap is retained. The teeth may be further secured to the flaps in any suitable way, including, for example, by means of adhesive, pressure, heat by being injection moulded onto the flaps. In one preferred embodiment the teeth are shaped and/or arranged so that, as the teeth of the opposing flaps are drawn together, there is interleaving of the teeth.

[0018] In another preferred embodiment each tooth of one flap is arranged to be aligned with a tooth on the opposed flap.

[0019] The through opening of a tooth may be adapted to reduce frictional forces between the lace and sides of the openings. In one preferred embodiment the surface of the opening on which the lace bears is curved in the direction of the lace and may also be grooved around its periphery.

[0020] In another preferred embodiment the surface on which the lace bears is provided by a rotatable pulley wheel mounted in the tooth.

[0021] Only one lace is required in the system of the invention for tensioning which eliminates the friction of crossing laces. The lace may follow approximately the form of a sine wave to create minimal friction. When the lace is tensioned less friction is created on the lace, compared to eyelet systems. However, for some purposes it may be advantageous to have more than one lace in order to provide separate areas over which tensioning may be different. Each lace may have its own locking means, although it is possible to run more than one lace through a single locking means.

[0022] The system using pulley wheels in the teeth is especially suitable for longer lace systems with greater loadings, whereby a pull on the end of the lace more easily transmits the tension through the whole system. This allows for speedy and effortless tensioning and loosening of the system.

[0023] The lace tensioning system of the invention is preferably provided as a complete unit that can be fitted in the same manner as a zip fastener. Thus, the flaps are preferably tapes that can be fixed into suitable items of, for example, clothing or footwear, say by adhesive

or stitching.

[0024] It is envisaged that lace tensioning systems of the invention will be produced on machinery similar to that producing moulded tooth zips, where each tooth is bonded to the tape by adhesive, pressure, heat or by injection moulding on to the tape for example. The pulley version of the invention would require a further manufacturing step to insert the pulleys and locating pins.

[0025] It is envisaged that the invention may share the following characteristics of zips. It may be produced as a continuous tape which may be cut to any required length and assembled into a functioning unit. It may be available in different sizes for different applications, depending on the loadings necessary and styling requirements. For example, a lacing system for women's clothing may be sized smaller than one for mountaineering boots. Within each size, any required length may be produced.

[0026] While the most obvious applications include footwear and clothing, the invention may have many other potential applications, where parts are to be drawn together under tension.

[0027] This invention will now be further described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a first embodiment of the invention; Figure 2 is a side view of a component of the embodiment of Figure 1;

Figure 3 is a plan view of the component of Figure 2; Figure 4 is a side view of another component of the embodiment of Figure 1;

Figure 5 is a view from another side of the component of Figure 4;

Figure 6 shows a second embodiment of the invention;

Figure 7 is a side view of a component of the embodiment of Figure 1;

Figure 8 is a plan view of the component of Figure 7; Figure 9 is a side view of another component of Figure 6;

Figure 10 is another side view of the component of Figure 9;

Figure 11 shows a third embodiment of the invention;

Figure 12 is a side view of a locking component of the embodiment of Figure 12;

Figure 13 is a plan view of the locking component of Figure 12;

Figure 14 is a view from one side of a plug component for lace end of the embodiment of Figure 11;

Figure 15 is a plan view of the plug component of Figure 14; and

Figure 16 is a view from the other side of the plug component of Figure 14;

Figure 17 shows a fourth embodiment of the invention;

Figure 18 shows a fifth embodiment of the inven-

tion;

Figure 19 shows a sixth embodiment of the invention;

Figure 20 shows a seventh embodiment of the invention;

Figures 21 to 24 show plug members for use with embodiments of the invention in plan and side views;

Figure 25 shows an eighth embodiment of the invention; and

Figure 26 shows a ninth embodiment of the invention.

[0028] Referring to Figures 1 to 5 of the accompanying drawings, a lace tensioning system suitable for boots and shoes comprises a pair of tapes 10, 12 connected at one end by a cross tape 14, so that the tapes 10, 12 are spaced apart. The tapes 10, 12 have thickened facing edges 16. In some circumstances the tapes 10, 12 will not be connected at either end but rather be open.

[0029] Mounted on the thickened facing edges 16 are teeth 18. Each tooth has at one end a slit 20 which has a narrow entrance 22 and a wider generally circular end part 24. The slits are angled relative to the plane of the teeth. This allows for the normal angle at which the tapes will lie when fitted into a boot or shoe. The slit 20 is to enable the teeth to be securely held onto the tapes 10, 12 with the thickened edges 16 thereof in the end part 24. The teeth may be injection moulded onto the tapes. A tooth 18 has, at its opposite end to the slit 20 a slot 26 which has mounted near its open end a rotatable pulley wheel 28 leaving a space between the pulley wheel and the closed end of the slot. The pulley wheel 28 is held in place by a hollow pin 30 through the wheel 28 and sides of the slot 26.

[0030] The teeth 18 on tape 10 are arranged to interleave with the teeth 18 on tape 12. For that purpose the teeth have a generally triangular shape in face view narrowing towards the pulley wheel end.

[0031] A cord 32 runs through each tooth in turn from side to side behind the pulley wheels in the slots 26.

[0032] At each end the cord has an enlargement or knot 63, formed thereon to prevent it from coming through each of the top and bottom teeth. On the cord is a locking member 64. A loop 66 of the cord pass through the locking member.

[0033] The locking member 64 comprises a body with a through slot through which a loop of cord is fitted. Slidably mounted within the body is a wedge member 68. The wedge member has serrated sides (not shown) to grip the loop of cord in the body when the wedge member is pushed into the body. When the lace has been pulled tight, the loop is pulled through the locking member until the locking member is more or less hard up against a tooth 18. Then the wedge 68 is pushed inwards to lock the lace into position.

[0034] On the loop of cord 66 is a plug member 70. The plug member 70 has a generally cuboid body 72

with a through hole 74 for the cord and a pin 76. The pin 76 has deformable faces that can be resiliently pressed together so that it can be pushed into a hollow pin 30 of a tooth 18 and held there. Thus, the loop of cord can be stretched out and secured so as not to be a loose hindrance.

[0035] Turning to Figures 6 to 10 of the accompanying drawings, the main differences between this embodiment and the previously described embodiment reside in the form of the teeth and of the plug member. Like parts have been given the same reference numbers. Instead of having a pulley wheel, the teeth 18¹ have their slots 26 bridged by an integral shaped part 50. The part 50 is curved in the direction of the lace and has a groove 52 around its periphery within the tooth 18¹. The groove 52 is to accommodate the lace 32 in the same way as the pulley wheel 28 of the previous embodiment.

[0036] There will obviously be greater friction forces to overcome in tensioning the lace in this embodiment rendering it more suitable in shorter lengths than the previous embodiment, which, because of the reduction in friction afforded by the use of pulley wheels, renders it more suitable for use in longer lengths.

[0037] The teeth 18¹ each have a through hole 80 normal to the direction of the cord hole. The through hole 80 has a constriction 82 at about its mid-way point. The constriction is provided to locate in corresponding grooves of resilient legs 84 of plug member 86 on loop 66 of the cord. Thus, the loop 66 of the cord can be tidied up in the same way as in the previous embodiment by locating the plug member 86 in the through hole 80 of an appropriately positioned tooth.

[0038] To use the system of Figure 6, the cord is pulled tight where it is looped through the locking member and the slack in the loop taken up by sliding the locking member towards the lacing system and wedging the loop by pushing the wedging member into the locking member body. Then the loop is stretched with the plug member at the end of the loop and the plug member inserted into the hole of the nearest tooth.

[0039] Finally, in Figures 11 to 16 of the accompanying drawings modifications to either of the basic lace tensioning system of Figures 1 and 6 are shown and will be described below in detail. The same reference numbers have been used for like parts except that it should be noted that the teeth 18¹ may be substituted by teeth 18 of the type shown in Figure 1.

[0040] Firstly, a lace locking means 100 is fitted onto a tooth 18¹. The locking means 100 is pivotally mounted on a tooth 18 by means of a pin through the hollow pin 30 or hole 80 of a tooth to pivot in the plane of the tooth in order to exert a locking force onto the lace running through the tooth. The locking means 100 has a wedging finger 102 with a profiled gripping surface 104 that bears onto the lace when pivoted towards the lace by jamming it against the tooth. The lace can be released by pulling on it.

[0041] In order for the lace tensioning system of the

invention to be useful for footwear for games involving ball contact, the loose end of the lace ought not to be prominent. To that end, the second modification shown in Figures 11 to 16 concern a plug 110 (see Figures 14 to 16 especially) attached to the free end of the lace 32. As with the previous embodiments, the plug 110 fits into the hollow pin 30 or hole 80 of a tooth 18 or 18¹ respectively.

[0042] The plug 110 comprises a body 112 having a hollow block 114 at one end with a through hole having a smaller entry 116 to receive the lace and a longer end portion 118 to accommodate a knot at the end of the lace to retain the plug on the lace. At its other end the body 112 has a pin 120 of the same form as pin 76 shown in Figure 4 of the drawings that can fit into the hollow pin 30 or hole 80 of a tooth 18 or 18¹.

[0043] The system of Figures 11 to 16 is used by pulling the free end of the lace to draw the flaps together. At a desired tension the locking means 100 is pivoted towards the lace to grip same and the free end of the lace is tidied up by fitting the plug 110 to an appropriate tooth.

[0044] Turning to Figure 17 there is shown an open-ended lace tensioning system 200 having a pair of tapes 202 each with a series of teeth 204 arranged to interleave with each other on the tapes are drawn together by tensioning lace 206 threaded alternately through teeth of the opposed series. The teeth 204 are of the pulley type as shown in Figures 2 and 3 of the drawings. Each of two loops 210, 212 of the lace, each between a pair of opposed teeth, pass through a locking member 214, 216 respectively, each of the same type as 64 in Figure 1. On each loop is a plug member 218 through which the lace is free to slide. The plug members 218 are shown in more detail in Figure 22 of the drawings but also corresponds to the plug member 70 shown in Figures 4 and 5 of the drawings.

[0045] The system of Figure 17 is used by pulling on the loops 210, 212 to tighten the lace and draw the tape edges towards each other. When the tape edges are as close as desired and as much of the loops is pulled through the locking members as possible. The wedge members of the locking members are pushed in to lock the lace against loosening movement. Then the remainders of the loops are tidied up by pulling them to their limits and inserting their respective plug members 218 into appropriate holes 220 of appropriate teeth 204, the holes being provided by hollow pins for pulley wheels of the teeth.

[0046] In Figure 18 of the drawings, an open-ended lace tensioning system 300 comprises a pair of tapes 302 each having a series of teeth 304 of the type illustrated in Figures 7 and 8 of the drawings. The teeth of one tape are arranged to be opposite the teeth of the other tape rather than for interleaving. A lace 306 is fed through every other tooth alternately from side to in one direction and back in the same way through the remaining teeth. The lace ends are knotted together and the

knot concealed in plug member 308, which is of the type shown in Figure 23 of the drawings.

[0047] The two end teeth 304 at the knot end of the lace are provided with spring loaded locking cams 310 which are of the type shown in Figures 12 and 13 of the drawings. The cams 310 may be pivoted inwards to allow the lace to be tensioned. Thereafter, once released, the cams will due to the lace tension tend to lock it against movement that would reduce the tension.

[0048] Once the lace has been tensioned the plug member 308 can be used to tidy up the loose loop of the lace by inserting the plug member in an appropriate hole 312 of a tooth 304.

[0049] The lace tensioning system 400 of Figure 19 has the same basic tape and teeth arrangement as in Figure 18. The difference is, however, in the lace arrangement. Two laces 402 and 404 are laced from opposite ends of the system 400 in a similar way to that of Figure 18 but the free ends of each lace are passed through the same locking member 406 of the same type as 64 shown in Figure 1 of the drawings. The free ends of each lace are knotted together and the respective knots 408, 410 concealed in plug members 412 and 414. The plug members are of the type shown in Figure 23 of the drawings.

[0050] The system of 400 is tensioned by pulling on both laces as desired and then locking them using the locking member 406, loose ends being tidied up using the plug members 412 and 414 as described for other embodiments.

[0051] A modification of the system of Figure 19 is shown in Figure 20, in which again there are two separate laces 502, 504 but each has its own locking member 506. This arrangement allows for different lace tensions to be achieved over different areas of the system.

[0052] Figures 21, 22, 23 and 24 simply show different types of plug members for use with lace tensioning systems of the invention. The types of Figures 21 and 23 are for use with teeth that simply have a through slot for the lace and the types of Figures 22 and 24 are for use with pulley type teeth. Furthermore, the types of Figures 21 and 22 are for use with systems in which the teeth are arranged for interleaving and the types of Figures 23 and 24 are for systems in which the teeth are aligned. The plug members of Figures 21 and 22 allow the lace or cord to move through them but in Figures 23 and 24 the plug members actually conceal the knots joining lace ends.

[0053] Figure 25 of the drawings shows a lace tensioning system 600 which is closed at both ends and uses an elasticated cord 602 threaded alternately between opposed teeth 604, of the type shown in Figures 2 and 3 of the drawings, arranged to interleave.

[0054] Finally, Figure 26 of the drawings shows a lace tensioning system 700 comprising a tape 702 with a series of teeth 704 thereon of the pulley type (see Figures 2 and 3) and a bar 706. A lace 708 is alternately threaded through a tooth 704 and around the bar 706. The lace

has an enlargement 710 at each end and the slack of the lace when tensioned is taken up by a locking member 712 of the type described above and a plug member 714 of the Figure 21 type.

Claims

1. A lace tensioning system comprising a plurality of teeth (18) on an edge (16) of a flap (702), each tooth (704) having a first opening (26) therethrough and a lace (708) threaded through the teeth (704) alternately with an article to which the lace tensioning system is to be connected, whereby tensioning of the lace (708) draws the teeth (704) and the article towards each other, and whereby the lace is being provided with means on the lace for taking up slack in the lace (708), the lace tensioning system being **characterised by** the means on the lace for taking up slack in the lace (708) comprising a peg (714) or the like on the lace (708), which peg (714) is locatable in a selectable component of the system.

2. A lace tensioning system comprising a plurality of teeth (18) on an edge (16) of a flap (12), each tooth (18) having a first opening (26) therethrough and a lace (32) threaded through the teeth (18) alternately with an article to which the lace tensioning system is to be connected, whereby tensioning of the lace (32) draws the teeth (18) and the article towards each other, the teeth (18) each having a second hole (30) at right angles to the plane of the flap, and whereby the lace is being provided with means on the lace for taking up slack in the lace (708), the lace tensioning system being **characterised by** the means for taking up slack in the lace (32) comprising a peg (70) or the like in the lace, the second hole (30) receiving the peg (70) or the like on the lace (32).

3. A lace tensioning system as claimed in claim 1 or 2, wherein the article to which the system is connected is a frame member (706).

4. A lace tensioning system as claimed in claim 1 or 2 wherein the article to which the system is connected is another set of teeth (18) on an opposing flap (10).

5. A lace tensioning system as claimed in any one of claims 1 to 4, wherein the lace (32) has free ends (63) that are enlarged in some way to prevent them being pulled through end teeth (13).

6. A lace tensioning system as claimed in any one of claims 1 to 4, wherein the lace (306) is continuous.

7. A lace tensioning system as claimed in any one of claims 1 to 6, having two or more laces (502, 504)

for different parts of the system.

8. A lace tensioning system as claimed in any one of claims 1 to 7, wherein one or more locking means (64) are provided on the lace (32) to take up slack in the lace (32).

9. A lace tensioning system as claimed in claim 7, wherein two laces (402, 404) use the same locking means (406).

10. A lace tensioning system as claimed in claim 7, wherein each lace (502, 504) has its own locking means (506).

11. A lace tensioning system as claimed in claim 8, 9 or 10, wherein the or each locking means (64) is provided intermediate the ends of the lace (32).

12. A lace tensioning system as claimed in claim 8, 9 or 10, wherein the locking means is associated with a tooth (304) of the lace tensioning system.

13. A lace tensioning system as claimed in claim 12, wherein a tooth (304) has wedging means (310) pivotally arranged on the tooth (304) whereby the wedging means (310) can be moved so as to trap the lace (306) between itself and a part of the tooth (304) over which the lace (306) passes.

14. A lace tensioning system as claimed in claim 13, wherein the wedging means (310) has a profiled gripping surface.

15. A lace tensioning system as claimed in claim 11, wherein the locking means (64) has a body through which a loop of the lace (32) passes and means associated with the body to lock the loop to the body.

16. A lace tensioning system as claimed in claim 15, wherein said locking means (64) comprises a wedge member (68) movable in the body and between the sides of the loop between a first position where the loop is free to move and a second position where the wedge traps the sides of the loop against the inside of the body.

17. A lace tensioning system as claimed in any one of claims 1 to 16, wherein the peg (70) is on a loop of the lace (32) or on a free end thereof.

18. A lace tensioning system as claimed in claim 17, wherein the peg (70) is on a loop of the lace (32) created by a locking means (64).

19. A lace tensioning system as claimed in any one of claims 1 to 18, wherein the peg (70) locates in a selected tooth (18) of the lace tensioning system.

20. A lace tensioning system as claimed in any one of claims 1 to 19, wherein the peg (70) has a resiliently deformable part (76) which is compressed to enter a hole (30) of a tooth (18) and retained by expansion.

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21. A lace tensioning system as claimed in any one of claims 1 to 20, wherein the flaps (10, 12) are provided with thickened edges (16) and the teeth (18) have slots (20) shaped to be retained on said thickened edges (16).

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22. A lace tensioning system as claimed in any one of claims 1 to 21, wherein the teeth (18) are shaped and/or arranged so that, as the teeth (18) of the opposing flaps (10, 12) are drawn together, there is interleaving of the teeth (18).

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23. A lace tensioning system as claimed in any one of claims 1 to 21, wherein each tooth (304) of one flap (302) is arranged to be aligned with a tooth (304) on the opposed flap (302).

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24. A lace tensioning system as claimed in any one of claims 1 to 23, wherein the surface of the opening (26) on which the lace (32) bears is curved in the direction of the lace and grooved (52) around its periphery.

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25. A lace tensioning system as claimed in any one of claims 1 to 23, wherein the surface on which the lace (32) bears is provided by a rotatable pulley wheel (28) mounted in the tooth (18).

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Patentansprüche

1. Schnürverschlussssystem mit einer Vielzahl von Zähnen (18) an einem Rand (16) einer Lasche (702), wobei jeder Zahn (704) eine erste Öffnung (26) hierdurch aufweist, und mit einem Schnürband (708), welches durch die Zähne (704) abwechselnd mit einem Gegenstand gefädelt ist, mit welchem das Schnürverschlussssystem verbunden werden soll, wobei durch Zugbeanspruchung des Schnürbandes (708) die Zähne (704) und der Artikel in Richtung aufeinander zu gezogen werden, und wobei das Schnürband mit einem Mittel an dem Schnürband zum Straffen des Schnürbands (708) versehen ist, wobei das Schnürverschlussssystem **gekennzeichnet ist durch** das Mittel an dem Schnürband zum Straffen des Schnürbandes (708), welches einen Stöpsel (714) oder dergleichen an dem Schnürband (708) umfasst, welcher Stöpsel (714) an einem wählbaren Bestandteil des Systems positionierbar ist.

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2. Schnürverschlussssystem mit einer Vielzahl von

Zähnen (18) an einem Rand (16) einer Klappe (12), wobei jeder Zahn (18) eine erste Öffnung (26) hierdurch aufweist, und mit einem Schnürband (32), welches durch die Zähne (18) abwechselnd mit einem Artikel gefädelt ist, mit welchem das Schnürverschlussssystem verbunden werden soll, wobei durch Zugbeanspruchung des Schnürbandes (32) die Zähne (18) und der Artikel in Richtung aufeinander zu gezogen werden, wobei jeder Zahn (18) eine zweite Loch (30) in einem rechten Winkel zu der Ebene der Klappe aufweist, und wobei das Schnürband mit einem Mittel an dem Schnürband zum Straffen des Schnürbands (32) versehen ist, wobei das Schnürverschlussssystem **gekennzeichnet ist durch** das Mittel zum Straffen des Schnürbandes (32), welches einen Stöpsel (70) oder dergleichen an dem Schnürband umfasst, wobei das zweite Loch (30) den Stöpsel (70) oder dergleichen an dem Schnürband (32) aufnimmt.

3. Schnürverschlussssystem nach Anspruch 1 oder 2, bei welchem der Artikel, mit dem das System verbunden ist, ein Rahmenglied (706) ist.

4. Schnürverschlussssystem nach Anspruch 1 oder 2, bei welchem der Artikel, mit dem das System verbunden ist, ein anderer Satz von Zähnen (18) an einer gegenüberliegenden Klappe (10) ist.

5. Schnürverschlussssystem nach einem der Ansprüche 1 bis 4, bei welchem das Schnürband (32) freie Enden (63) aufweist, die auf irgend eine Weise vergrößert sind, um zu verhindern, dass diese durch die Endzähne (18) gezogen werden.

6. Schnürverschlussssystem nach einem der Ansprüche 1 bis 4, bei welchem das Schnürband (306) endlos ist.

7. Schnürverschlussssystem nach einem der Ansprüche 1 bis 6, welches zwei oder mehrere Schnürbänder (502, 504) für verschiedene Teile des Systems aufweist.

8. Schnürverschlussssystem nach einem der Ansprüche 1 bis 7, bei welchem ein oder mehrere Verschlussmittel (64) an dem Schnürband (32) zum Straffen des Schnürbandes (32) vorgesehen sind.

9. Schnürverschlussssystem nach Anspruch 7, bei welchem zwei Schnürbänder (402, 404) das selbe Verschlussmittel (406) benutzen.

10. Schnürverschlussssystem nach Anspruch 7, bei welchem jedes Schnürband (502, 504) sein eigenes Verschlussmittel (506) aufweist.

11. Schnürverschlussssystem nach einem der Ansprü-

che 8, 9 oder 10, bei welchem das oder jedes Verschlussmittel (64) zwischen den Enden des Schnürbandes (32) vorgesehen ist.

12. Schnürverschlussssystem nach einem der Ansprüche 8, 9 oder 10, bei welchem das Verschlussmittel einem Zahn (304) des Schnürverschlussystems zugeordnet ist. 5
13. Schnürverschlussssystem nach Anspruch 12, bei welchem ein Zahn (304) ein Verkeilungsmittel (310) aufweist, welches schwenkbar am Zahn (304) angeordnet ist, bei welchem das Verkeilungsmittel (310) so bewegbar ist, dass das Schnürband (306) zwischen sich selbst und einem Teil des Zahnes (304), über welchem das Schnürband verläuft, festgeklemmt wird. 10 15
14. Schnürverschlussssystem nach Anspruch 13, bei welchem das Verkeilungsmittel (310) eine Profilgreiffläche aufweist. 20
15. Schnürverschlussssystem nach Anspruch 11, bei welchem das Verschlussmittel (64) einen Körper, durch welchen eine Schleife des Schnürbandes (32) verläuft, und ein dem Körper zugeordnetes Mittel zum Befestigen der Schleife an dem Körper aufweist. 25
16. Schnürverschlussssystem nach Anspruch 15, bei welchem das Verschlussmittel (64) ein Verkeilglied (68) umfasst, welches in dem Körper und zwischen den Seiten der Schleife bewegbar ist zwischen einer ersten Position, in welchem die Schleife frei zu bewegen ist, und einer zweiten Position, in welcher der Keil die Seiten des Schnürbandes gegen die Innenseite des Körpers klemmt. 30 35
17. Schnürverschlussssystem nach einem der Ansprüche 1 bis 16, bei welchem der Stöpsel (70) an einer Schleife des Schnürbandes (32) oder an einem freien Ende davon ist. 40
18. Schnürverschlussssystem nach Anspruch 17, bei welchem der Stöpsel (70) an einer mit einem Verschlussmittel (64) erzeugten Schleife des Schnürbandes (32) ist. 45
19. Schnürverschlussssystem nach einem der Ansprüche 1 bis 18, bei welchem der Stöpsel (70) an einem ausgewählten Zahn (18) des Schnürverschlussystems sitzt. 50
20. Schnürverschlussssystem nach einem der Ansprüche 1 bis 19, bei welchem der Stöpsel (70) ein elastisch verformbares Teil (76) aufweist, welches, um in ein Loch (30) des Zahns (18) hineinzugehen, zusammengedrückt und durch Ausdehnung zurück-

gehalten wird.

21. Schnürverschlussssystem nach einem der Ansprüche 1 bis 20, bei welchem die Klappen (10, 12) mit verdickten Rändern (16) versehen sind, und die Zähne (18) Schlitz (20) aufweisen, die zum Festhalten an den verdickten Rändern (16) geformt sind.
22. Schnürverschlussssystem nach einem der Ansprüche 1 bis 21, bei welchem die Zähne (18) so geformt und/oder angeordnet sind, dass beim Zusammenziehen der Zähne (18) der gegenüberliegenden Klappen (10, 12) die Zähne (18) ineinander greifend sind.
23. Schnürverschlussssystem nach einem der Ansprüche 1 bis 21, bei welchem jeder Zahn (304) einer Klappe (302) ausgerichtet mit einem Zahn (304) an der gegenüberliegenden Klappe (302) angeordnet ist.
24. Schnürverschlussssystem nach einem der Ansprüche 1 bis 23, bei welchem die Fläche der Öffnung (26), an welcher das Schnürband Zug ausübt, in Richtung des Schnürbandes gekrümmt und um ihren Umfang herum ausgekehlt (52) ist.
25. Schnürverschlussssystem nach einem der Ansprüche 1 bis 23, bei welchem die Fläche, auf der das Schnürband aufliegt, von einem im Zahn (18) eingebauten drehbaren Laufrad bereitgestellt wird.

Revendications

1. Un système de mise sous tension de lacets comprenant une pluralité de dents (18) sur un bord (16) d'une patte (702), chaque dent (704) ayant une première ouverture (26) à travers elle et un lacet (708) enfilé à travers les dents (704) alternativement avec un article auquel le système de mise sous tension de lacets doit être relié, dans lequel la mise sous tension du lacet (708) tire les dents (704) et l'article les uns vers les autres et dans lequel le lacet est muni de moyens sur le lacet pour rattraper le mou dans le lacet (708) le système de mise sous tension de lacets étant **caractérisé par le fait que** les moyens sur le lacet pour rattraper le mou dans le lacet (708) comprennent une cheville (714) ou similaire sur le lacet (708), laquelle cheville (714) peut être disposée dans un composant sélectionnable du système.
2. Un système de mise sous tension de lacets comprenant une pluralité de dents (18) sur un bord (16) d'une patte (12), chaque dent (18) ayant une première ouverture (26) à travers elle et un lacet (32)

enfilé à travers les dents (18) alternativement avec un article auquel le système de mise sous tension de lacets doit être relié, dans lequel la mise sous tension du lacet (32) tire les dents (18) et l'article les uns vers les autres, les dents (18) ayant chacune un second orifice (30) à angle droit par rapport à la patte, et dans lequel le lacet est muni de moyens sur le lacet pour rattraper le mou dans le lacet (708), le système de mise sous tension de lacets étant **caractérisé par le fait que** les moyens sur le lacet pour rattraper le mou dans le lacet (32) comprennent une cheville (70) ou similaire sur le lacet, le second orifice (30) recevant la cheville (70) ou similaire sur le lacet (32).

3. Un système de mise sous tension de lacets tel que revendiqué à la revendication 1 ou 2, dans lequel l'article auquel le système est relié est une barre (706).
4. Un système de mise sous tension de lacets tel que revendiqué à la revendication 1 ou 2, dans lequel l'article auquel le système est relié est une autre série de dents (18) sur une patte (10) opposée.
5. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 4, dans lequel le lacet (32) a des extrémités libres (63) qui sont élargies d'une manière quelconque pour les empêcher d'être tirées à travers des dents (18) d'extrémité.
6. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 4, dans lequel le lacet (306) est continu.
7. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 6, ayant deux lacets (502, 504) ou plus pour différentes pièces du système.
8. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 7, dans lequel un ou plusieurs moyens de verrouillage (64) sont prévus sur le lacet (32) pour rattraper le mou dans le lacet (32).
9. Un système de mise sous tension de lacets tel que revendiqué à la revendication 7, dans lequel deux lacets (402, 404) utilisent le même moyen de verrouillage (406).
10. Un système de mise sous tension de lacets tel que revendiqué à la revendication 7, dans lequel chaque lacet (502, 504) a son propre moyen de verrouillage (506).
11. Un système de mise sous tension de lacets tel que

revendiqué à la revendication 8, 9 ou 10, dans lequel le ou chaque moyen de verrouillage (64) est disposé entre les extrémités du lacet (32).

12. Un système de mise sous tension de lacets tel que revendiqué à la revendication 8, 9 ou 10, dans lequel le moyen de verrouillage est associé à une dent (304) du système de mise sous tension de lacets.
13. Un système de mise sous tension de lacets tel que revendiqué à la revendication 12, dans lequel une dent (304) a un moyen de blocage (310) monté à pivotement sur la dent (304), dans lequel le moyen de blocage (310) peut être déplacé de manière à coincer le lacet (306) entre lui-même et une partie de la dent (304) sur laquelle passe le lacet (306).
14. Un système de mise sous tension de lacets tel que revendiqué à la revendication 13, dans lequel le moyen de blocage (310) a une surface de prise profilée.
15. Un système de mise sous tension de lacets tel que revendiqué à la revendication 11, dans lequel le moyen de verrouillage (64) a un corps à travers lequel passe une boucle du lacet (32) et des moyens associés au corps pour verrouiller la boucle au corps.
16. Un système de mise sous tension de lacets tel que revendiqué à la revendication 15, dans lequel ledit moyen de verrouillage (64) comprend un organe de blocage (68) mobile, dans le corps et entre les côtés de la boucle, entre une première position dans laquelle la boucle est libre de se déplacer et une seconde position dans laquelle l'organe de blocage coince les côtés de la boucle contre l'intérieur du corps.
17. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 16, dans lequel la cheville (70) est sur une boucle du lacet (32) ou sur une extrémité libre de celui-ci.
18. Un système de mise sous tension de lacets tel que revendiqué à la revendication 17, dans lequel la cheville (70) est sur une boucle du lacet (32) créée par un moyen de verrouillage (64).
19. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 18, dans lequel la cheville (70) est logée dans une dent (18) sélectionnée du système de mise sous tension de lacets.
20. Un système de mise sous tension de lacets tel que

revendiqué à l'une quelconque des revendications 1 à 19, dans lequel la cheville (70) a une partie (76) élastiquement déformable qui est comprimée pour entrer dans un orifice (30) d'une dent (18) et maintenue par expansion.

5

21. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 20, dans lequel les pattes (10, 12) sont munies de bords (16) épaissis et les dents (18) ont des fentes (20) conformées pour être retenues sur lesdits bords (16) épaissis.

10

22. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 21, dans lequel les dents (18) sont conformées et/ou agencées de telle manière que, lorsque les dents (18) des pattes (10, 12) opposées sont tirées ensemble, il y a un intercalement des dents (18).

15

20

23. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 21, dans lequel chaque dent (304) d'une patte (302) est agencée pour être alignée avec une dent (304) sur la patte (302) opposée.

25

24. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 23, dans lequel la surface de l'ouverture (26) sur laquelle porte le lacet (32) est courbée en direction du lacet et striée (52) autour de sa périphérie.

30

25. Un système de mise sous tension de lacets tel que revendiqué à l'une quelconque des revendications 1 à 23, dans lequel la surface sur laquelle porte le lacet (32) est formée par une roue de poulie (28) rotative montée dans la dent (18).

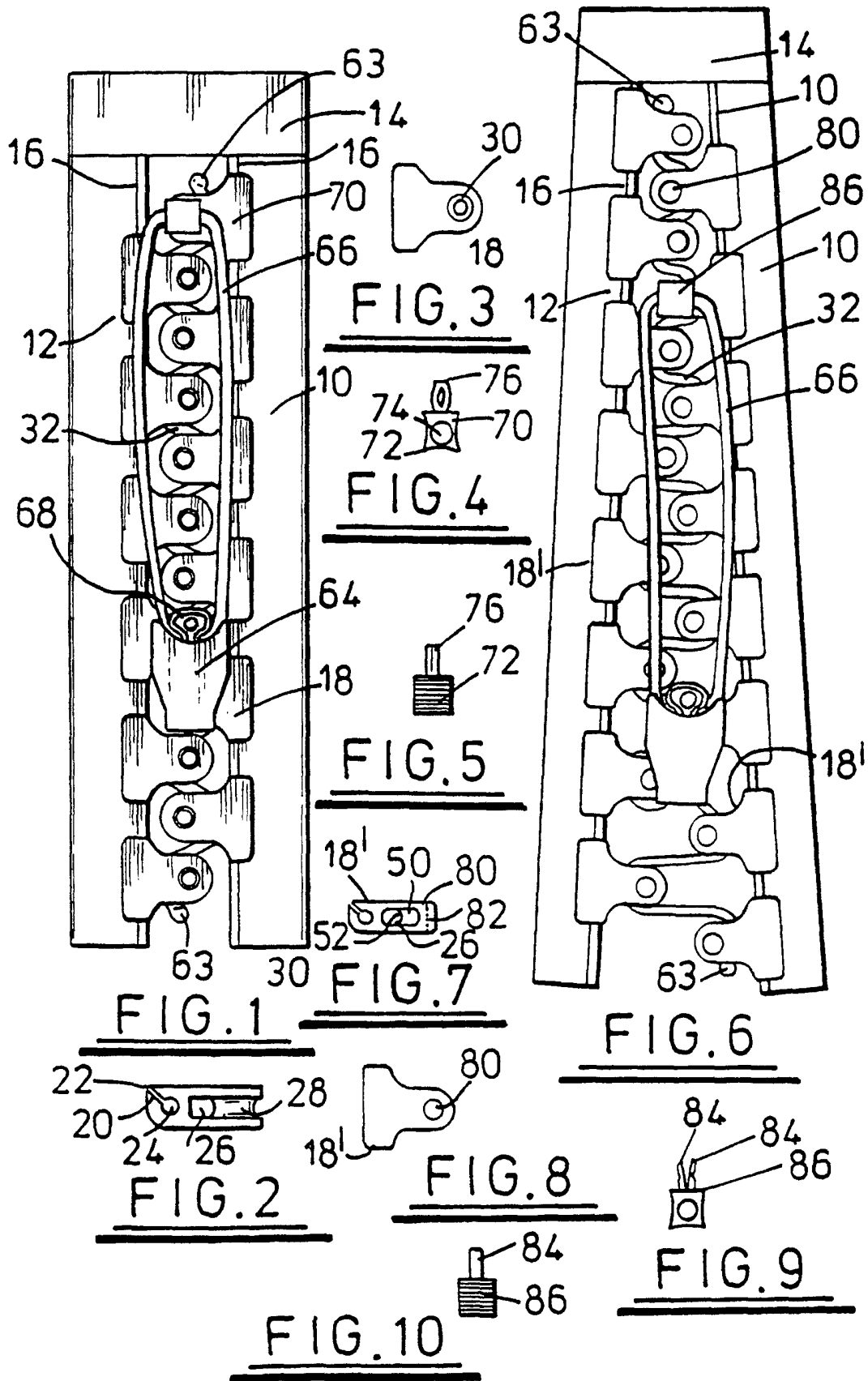
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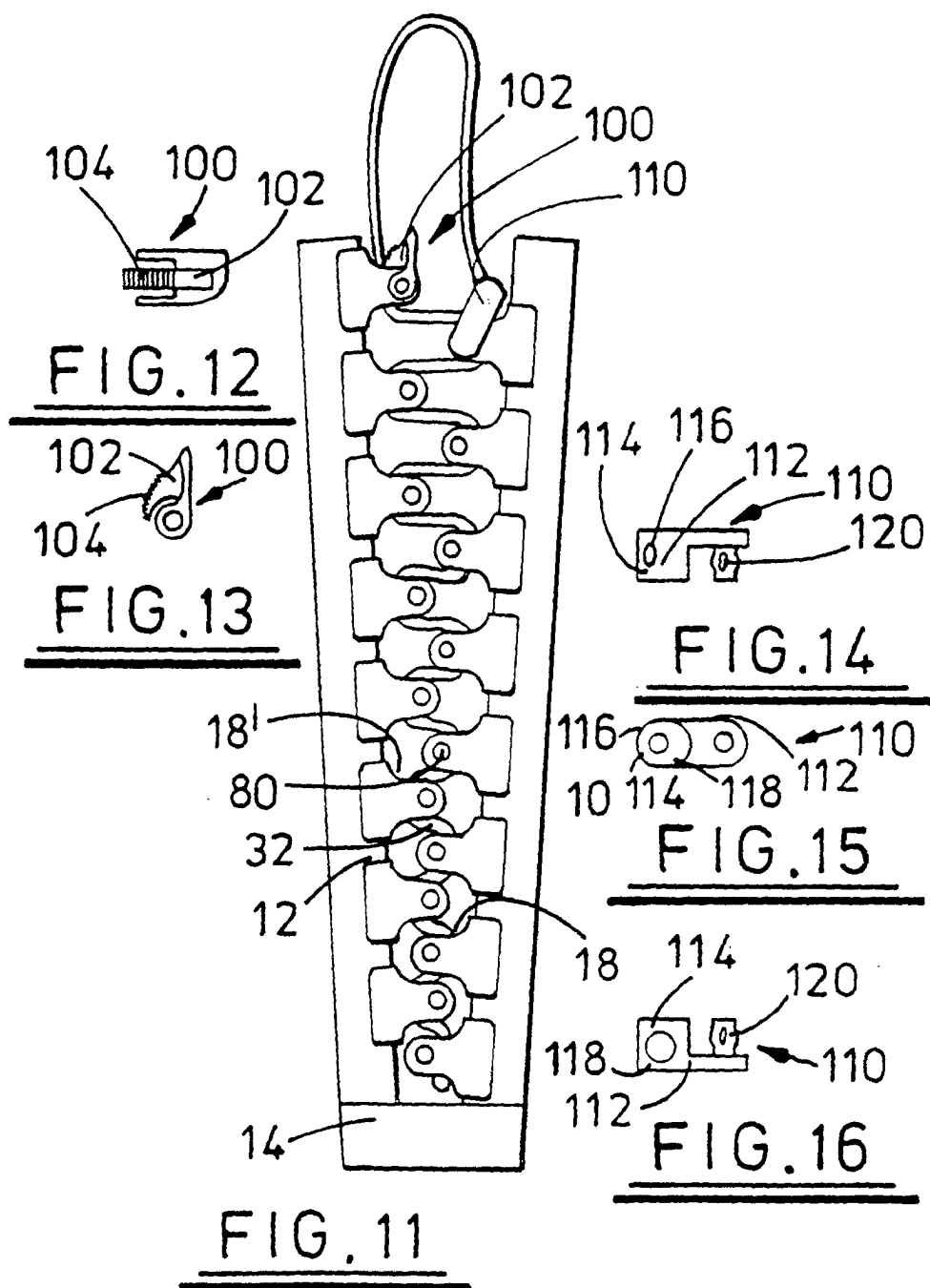
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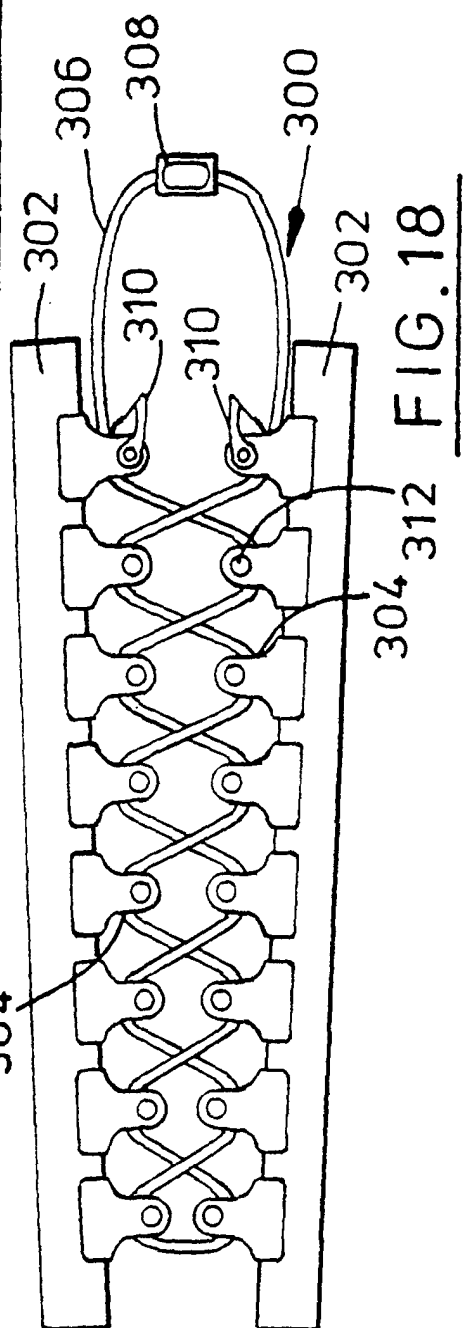
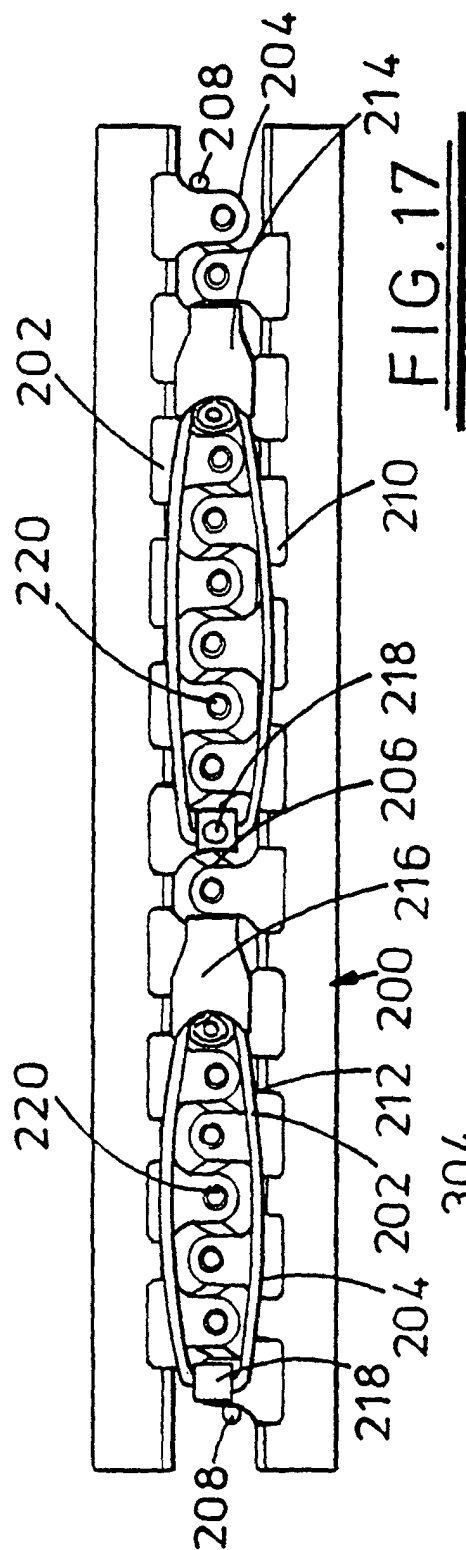
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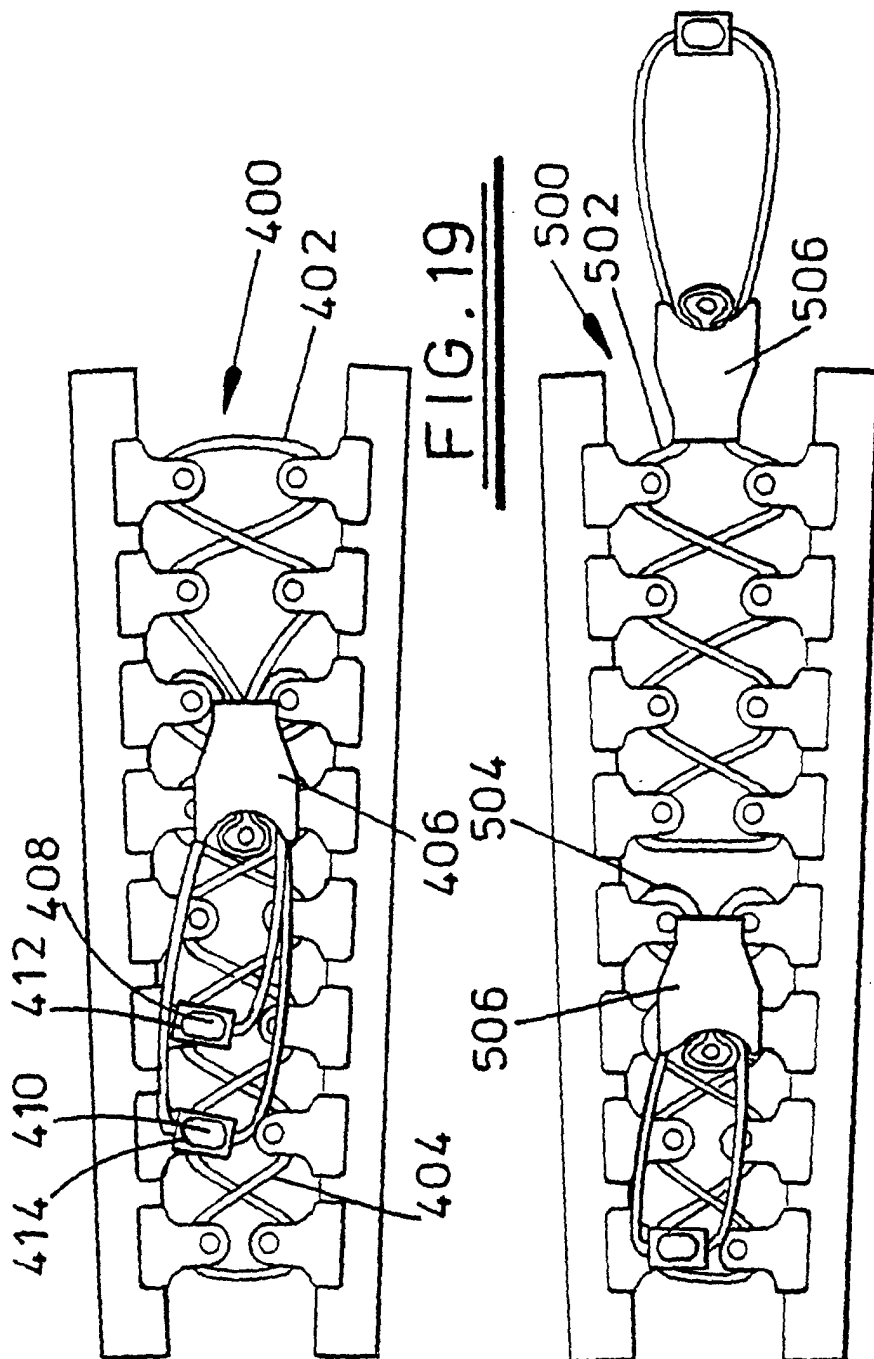
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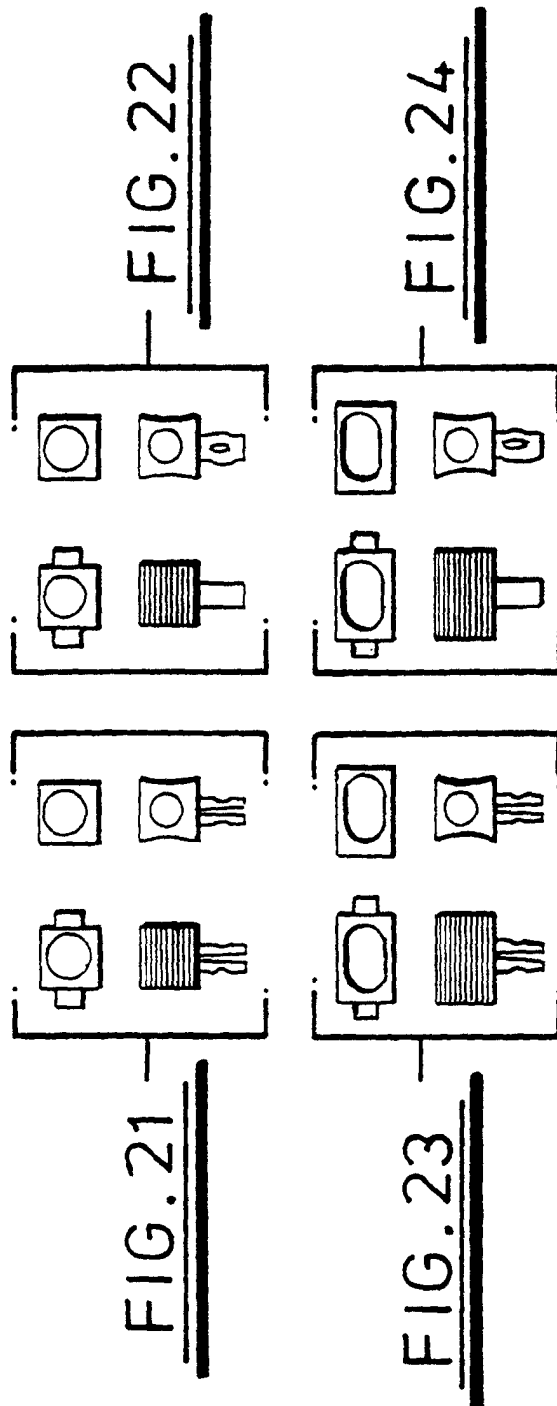
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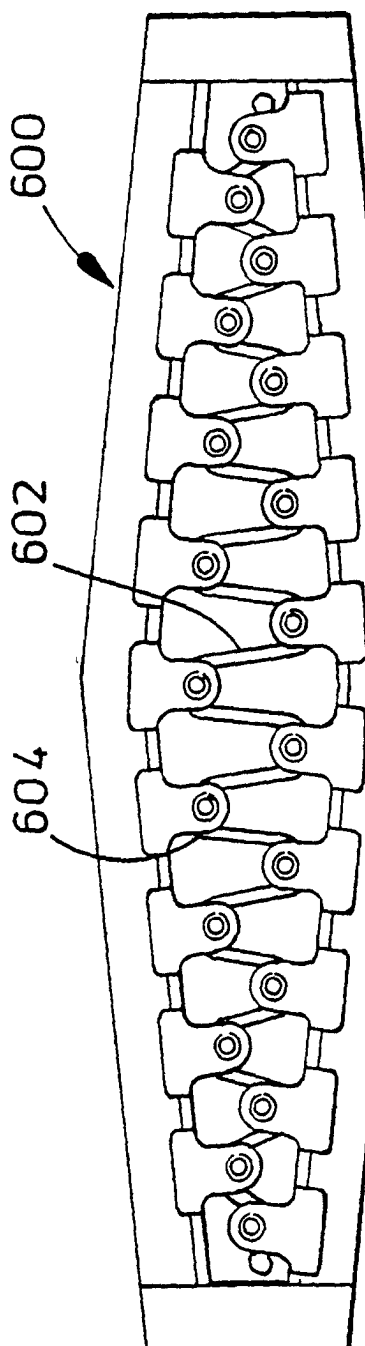


FIG. 25

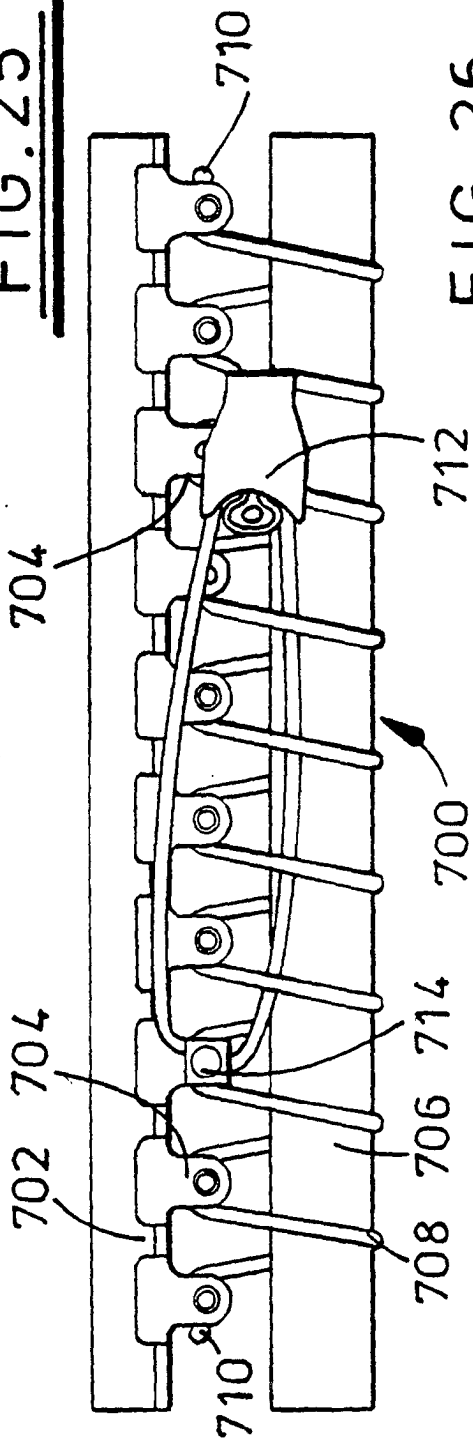


FIG. 26