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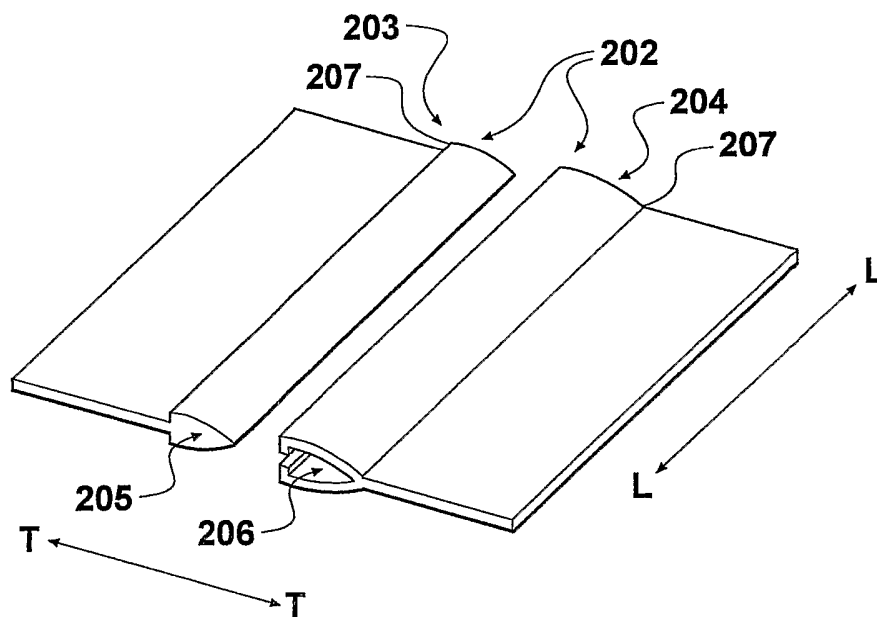
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(54) Title: FLUID RESISTANT ZIP



(57) Abstract: A fluid resistant plastics zip (202) for use on wet suits, wet weather clothing, bags, safety wear and sports equipment plastics zip for clothing capable of providing longitudinal stretchability has two mutually engageable zip tracks (203, 204). A slotted female zip track (204) is capable of merging with a complementary male zip track (203) within a slider (215). The female and male elongate zip tracks each being of constant and complementary cross section (205, 206) so that the male profile fits within the female profile when merged to provide a fluid barrier across the zip when the zip is closed.

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**FLUID RESISTANT ZIP**

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## TECHNICAL FIELD OF THE INVENTION

The present invention relates to improvements to zip fasteners (abbreviated to “zips”) and in particular, although not solely, to zips which provide a fluid barrier or are water resistant or fluid tight for the use in garments, clothing (especially wet weather gear), bags, footwear, safety wear (especially chemical safety clothing), and sports equipment (e.g. tents, racquet covers and wetsuits). The term “fluid tight” used herein relates primarily to the ability of a length of the zip to resist or impede the passage of water or other liquids (and does not deal with the properties of the garment or the ends of the zip).

## 15 BACKGROUND OF THE INVENTION

The most common forms of zip that are used in the garment industry utilise two zipper tracks presenting a series of tooth like elements which are able to move in and out of engagement with each other by the use of a slider. The slider is an element which can be moved by hand to slide along the row of teeth of the zipper tracks for the purposes of the merging and demerging of the zipper tracks as and when desired or required.

Such known zipper tracks have the benefit of providing significant resistance to a pulling apart of the zipper tracks in a direction lateral to the longitudinal direction of the zip when the zipper tracks are merged with each other. This is because interlocking features of each of the teeth of the zipper track occurs when the zipper tracks are merged with each other.

25 Such zipper tracks whilst providing significant resistance to a lateral separation of the zipper tracks, do not provide any significant barrier to the displacement of fluid such as water and for that matter even air from one side of the garment-to the other. This is as a result of

the fact that the teeth of the zipper track are individual elements which even when in a merged condition, still provide a path for fluid communication between one sides of the garment to the other. As a result of the intermittent nature of the teeth (i.e. the sequential provision of a tooth, then gap, then tooth etc.) such known zips are not water tight in their own  
5 right but can be made water tight by the provision of additional layers of material covering the zipper tracks once merged. However the provision of a toothed zipper track with such additional provisions for waterproofing requires additional steps in the manufacturing of the garment to occur.

## 10 DEFINITIONS

The following definitions relate to conventional toothed (chain) type zip fasteners but assist in explaining the component parts many of which have counterparts in the fastener of this invention.

### CHAIN

15 The continuous piece that is formed when both halves of a zipper are meshed together.

### CHAIN SIZE

Refers to the specific gauge of the chain, i.e., size of the teeth.

### TEETH

The individual elements that make up the chain.

## 20 SLIDER

The device that moves up and down the chain to open or close the zipper.

### PULL TAB

The part of the slider that you hold to move the slider up or down.

**MATERIAL**

Refers to the type of chain that is used in the construction of the zipper, such as, metal chain, moulded plastic chain or coil (nylon) chain.

**TAPE**

- 5 The fabric part of the zipper.

**TAPE WIDTH**

Refers to the width of the fabric on one side only, of the zipper chain.

**TAPE ENDS**

- 10 The fabric part of the zipper, that extends beyond the teeth, at the top and /or bottom of the chain.

**STYLE**

Refers to the manner in which the zipper is assembled for a particular application.

**TOP STOP**

Two devices affixed to the top of a zipper, to prevent the slider from coming off the chain.

- 15 **BOTTOM STOP**

A device affixed to the bottom of a zipper, to prevent further movement of the half of the zipper from separating.

**BRIDGE STOP**

- 20 A device similar to a bottom stop, used at the top of a zipper to prevent each half of the zipper from separating.

**PIN**

A device used on a separating (jacket type) zipper whose function is to allow the joining of the two zipper halves.

## PIN BOX

A device used on a separating (jacket type) zipper whose function is to correctly align the pin, to begin the joining of the zipper halves.

## HEAT SEAL PATCH

- 5 The cotton and nylon laminated material fused to the bottom end of a separating zipper, used to reinforce the type.

## HEAT-SEALABLE ZIPPERS (WELDABLE LAMINATED ZIPPERS)

- Any zipper that has a strip of plastic fused to each half of the zipper tape to allow a manufacturer to electronically "weld" the zipper onto the garment or item that is being  
10 manufactured, without the need of sewing or stitching.

## CONTINUOUS CHAIN

Any material or size of zipper chain that is continuously spooled without sliders or any other components. Typically used by fabricators on a cut-as-need basis.

## CUT-TO-LENGTH ZIPPERS

- 15 (Finished Zippers.) Any zipper that is finished to a specific length, with all necessary components attached.

## TYPES OF ZIPS

- Zip fasteners come in a variety of styles with one end closed, both ends closed, and both  
20 ends open. For example a trouser type zip has one end closed, and the slider retained on the zip by end stops. A bag type zip will typically have both ends of the zip closed and will typically have two sliders retained between the closed ends, so that as the sliders move towards the respective closed ends, the central portion of the zip fastener will open.

- Jacket type zips on the other hand have both ends of the zip fastener open so that the slider  
25 will be retained on one side of the zip fastener when the jacket is open. Such an open ended

zip fastener typically has a pin at the end of one side and a pin box on the other side of the zip fastener enabling the two sides to be connected together so that the slider can be used to merge the two sides of the zip fastener.

A number of other configurations have been used with conventional zip fasteners, and the zip fastener of this invention can be configured in all these different ways, whether or not they have all been illustrated in the attached drawings.

## REFERENCES

All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein; this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

## PRIOR ART

Zips which are known in the packaging industry comprising generally of mutually cooperative male and female extruded closure tracks, have been in use for many years. Whilst of more recent vintage, US6581253 illustrates the basic premise on which zipper tracks for packaging have been based for many years. A male track formed by continuous extrusion of a

plastics material and being of a ball profile is received within a complimentary shaped female track of a cup profile. Such tracks when merged remain in an interlocking condition with each other. The male track is often disposed at the end of a fastening flange and is of a cross sectional profile being substantially circular. The female track likewise disposed at an edge of a fastening flange is cup shape to surround at least a substantial part of the male profile. Whilst such zips have been in use for many years in the packaging industry it would appear that it is only since recent times that such are recognised as suitable for use with garments.

WO97/07702 illustrates an extruded zip consisting of a male zip track and a female zip track which are able to be merged and demerged by the use of a slider. However it would appear that the additional and contemporaneously mergable and demergable tooth like zip provided adjacent the extruded profile male/female zip is provided for the purposes of enhancing the lateral strength of the overall zip assembly to prevent the lateral separation of the closure provided by the assembly. The profile of the extruded male/female zip is such that on its own it would not present significant resistance to lateral separation of the tracks when mutually engaged. The profile of the extruded male/female zip is curved and does not provide or present any region or zones which enhance the grip between the male and female profiles to resist, to any significant extent, the lateral separation of the profiles. For garments, luggage and industrial applications, this would be a problem.

It would appear that it is hence necessary, to enhance the resistance to lateral separation by provision of the tooth like zip as shown in WO97/07702 to provide a useful product.

Zips which include teeth are typically not stretchable.

There also appears to be no reference in WO97/07702 in respect of the manner in which the female profile of the female zipper track is manipulated for the purposes of establishing a merged relationship with it and the male profile of the male zipper track. Most zipper tracks used in packaging result in the merging of the profiles by merely applying a pressure pushing the profiles together. Such a force to merge the profiles together may have detrimental effects on the integrity of at least the female profile and over time may result in the degradation of the female profile to the extent that its holding force and resistance to lateral separation diminishes. Such diminished performance can also result by the fact that separation or demerging of the profiles is merely by a pulling apart of the profiles without any enhanced or additional manipulation of the female profile to assist with such separation.

US6510595 describes extruded profile zipper tracks which are an enhancement on the ball and cup like zipper tracks commonly used in packaging in that the profile of the interlocking zipper tracks is such as to enhance the resistance to any lateral separation of the tracks. As can be seen, from the drawings of US6510595, the male track has a cutback with which corresponding and jaw like profiled regions of the female track can engage to enhance the resistance to lateral separation between the tracks. However the slide fastener of US6510595 is of a kind which replicates the manual merging and demerging of zipper tracks.

The slider is adapted to use force in the lateral direction to encourage the engagement and separation of the male and female profiles. Each of the profiles is provided at an edge of connection flanges (5, 8) and is provided with upstanding surfaces (17, 13) for the purposes of engagement therewith by inwardly directed surfaces of the slide fastener. The inwardly directed surfaces of the slide fastener are able to apply a force to the male and female tracks so that they are pressed towards each other for the purposes of establishing the engagement between the male and female profiles. As a result of the forcing of the profiles to become merged and demerged, the prior art requires a trade-off, of two important aspects that are desirable in a fluid tight zip.

#### OBJECT

Accordingly the present invention is directed towards and aims to provide an object which addresses the abovementioned disadvantages to provide a user friendly fluid resistant zip or to at least provide the public with a useful choice.

#### STATEMENT OF INVENTION

In one aspect the invention provides a fluid resistant zip for use on wet suits, wet weather clothing, bags, safety wear and sports equipment, said zip comprising two mutually engagable zip tracks, each track attached to or integral with a tape, and a slider capable of moving along the zip tracks to merge or demerge the tracks, wherein a first of said zip tracks has a female profile defining a slotted cavity with the slot extending along the length of the zip; and a second of said

zip tracks has a male profile capable of fitting within and being closely held by the female profile; and wherein at least the female profile is of uniform cross section along its length to present a barrier to fluids when the zip is closed.

5 Preferably the slider has guide means within the slider adapted to guide the male and female profiles towards one another for merging,

Preferably there is an expansion element within the slider adapted to open the slot of the female profile sufficiently to allow the female profile to fit over and capture the male profile so that the two tracks are merged together into a closed state,

10 Preferably the male profile is segmented or partly segmented along its length to increase its flexibility and/or stretchability

Preferably the male profile is of uniform cross section along its length.

Preferably each track is formed by extrusion or co-extrusion, or alternatively by an injection moulding process

Preferably the tape is formed of a water-resistant material.

15 Preferably the male profiles are generally cylindrical and the female profiles are generally C-shaped in cross section.

Preferably the male profile is generally wedge shaped with the tape attached to the base thereof, and the female profile is of a complementary wedge shape with a slot along the base of the female wedge shape and the tape attached to the apex of the female wedge shape.

20 Preferably the guide means includes a male slot adapted to allow passage of the male profile therethrough, and a female slot adapted to allow passage of the female profile therethrough, the male and female extending from an entrance end of the slider towards one another and towards a merged slot which exits from the other end of the slider track.

25 Preferably an expansion element is located in the female slot and has a tapered portion facing towards the entrance end so that it can be located in the cavity of the female profile.

Preferably said expansion element is engaged to the body of said slider by a bridge which is located where the mouth of said female channel passes through the channel of said slider.

In a second aspect the invention provides a fluid resistant zip for use on wet suits, wet weather clothing, bags, safety wear and sports equipment, said zip comprising two mutually engagable  
5 zip tracks, each track attached to or integral with a tape, and a slider capable of moving along the zip tracks to merge or demerge the tracks, wherein a first of said zip tracks has a female profile defining a slotted cavity with the slot extending along the length of the zip; and a second of said zip tracks has a male profile capable of fitting within and being closely held by the female  
10 profile; and wherein the slider has guide means within the slider adapted to guide the male and female profiles towards one another for merging, and an expansion element within said slider adapted to open the slot of the female profile sufficiently to allow the female profile to fit over and capture the male profile so that the two tracks are merged together into a closed state, and wherein at least the female profile is of uniform cross section along its length to present a barrier  
15 to fluids when the zip is closed.

Preferably the male profile is segmented or partly segmented along its length to increase its flexibility and/or stretchability.

Preferably the male profile is of uniform cross section along its length.

Preferably each track is formed by extrusion or co-extrusion, or alternatively by an injection  
20 moulding process.

Preferably the tape is formed of a water-resistant material.

Preferably the male profiles are generally cylindrical and the female profiles are generally C-shaped in cross section.

Preferably the male profile is generally wedge shaped with the tape attached to the base thereof,  
25 and the female profile is of a complementary wedge shape with a slot along the base of the female wedge shape and the tape attached to the apex of the female wedge shape.

Preferably the guide means includes a male slot adapted to allow passage of the male profile therethrough, and a female slot adapted to allow passage of the female profile therethrough, the

male and female extending from an entrance end of the slider towards one another and towards a merged slot which exits from the other end of the slider track.

Preferably the expansion element is located in the female slot and has a tapered portion facing towards the entrance end so that it can be located in the cavity of the female profile.

- 5 Preferably said expansion element is engaged to the body of said slider by a bridge which is located where the mouth of said female channel passes through the channel of said slider.

In another aspect the present invention consists in a fluid resistant zip comprising

- 10 a female zip track defining an elongate female channel a male zip track defining an elongate male profile of a shape to be capturable in the female channel of said female zip track,

- a slider for merging and demerging said male and female zip tracks, said slider including a channel for each of said male and female zip tracks, said channels being separated save for their merging as one, at or towards one perimeter region of said slider, each said channel being of a profile to allow the capture by said channel, yet the longitudinal sliding of said slider along, a respective zip track, an expansion element engaged to the body of said slider and disposed in the channel of said slider with which said female channel of said female zip track is located, said expansion element including a first and second distal end, said first distal end located at where said two channels of said slider merge as one, said second distal end located away therefrom, said first distal end of said expansion element being of a size expanding said female channel to a size larger than its steady state size, to hereby enhance the ease with which said male profile can merge and demerge with said female channel as said slider moves in the longitudinal direction.
- 15  
20

Preferably said expansion element is at or towards its first distal end of a size to cause the greatest expansion of the female channel.

- 25 Preferably said expansion element is tapered between its first and second distal ends, and provides its greatest size at or towards said first distal end.

Preferably said expansion element is a slender elongate body, of a size at its second distal end which is of a size to locate within said female channel of said female zip track without influencing its steady state size.

5 Preferably said expansion element extends at least partly into the merged region of said channels of said slider and is at its first distal end, provided in the merged region, profiled to allow the passing thereby of said male profile of said male zip track.

Preferably said channels of said slider merge at an acute angle to each other.

10 Preferably said expansion element is engaged to the body of said slider by a bridge which is located where the mouth of said female channel passes through the channel of said slider.

Preferably said bridge is an elongate member extending in the longitudinal direction of said channel of said slider within which it is located.

Preferably said expansion element is of a circular cross section.

Preferably said expansion element is at least partially tapered at least one end,

15 Preferably the female channel of said female zip track includes a region at or toward the mouth of said channel which is capable of engaging with a complementary shaped region of said male profile which grips the male profile when said male and female zip tracks are merged.

Preferably said region of said female channel is a cut back of the interior surface of said channel back towards the trough of said female channel.

20 Preferably said female zip track is made from a more rigid material than said male zip track.

Preferably said male zip track is of a more flexible material than said female zip track.

Preferably said male zip track is made from higher friction material than said female zip track.

25 Preferably said channels of said slider have disposed thereto, longitudinally extending slots extending to the perimeter of said slider to allow for connection flanges of each of said zip tracks respectively to extend away from said slider.

Preferably said female channel of said female zip track is of constant cross-section between distal ends of said female zip track.

Preferably said male profile is of constant cross-section between distal ends of said male zip track.

- 5 Preferably said male profile and said female channel are of constant cross-section between their respective zip track distal ends.

Preferably said channels of said slider are provided in the body of said slider in a manner to bring the two zip tracks together, when the slider is moved in one direction along the zip tracks, without the need to any significant force to be applied to the zip tracks to encourage their merging.

- 10 Preferably said slider is of a moulded plastic.

Preferably said slider is a three part assembled item.

Preferably said zip tracks are moulded.

Preferably said zip tracks are extruded.

- 15 In a further aspect the present invention consists in a fluid resistant zip which can be merged and demerged by a slider said zip comprising; a female zip track defining an elongate female channel, a male zip track defining an elongate male profile of a shape to be capturable in the female channel of said female zip track, wherein said slider for merging and demerging said male and female zip tracks, includes a channel for each of said male and female zip tracks, said channels being separated save for their merging as one, at or  
20 towards one perimeter region of said slider, each said channel being of a profile to allow the capture by said channel, yet the longitudinal sliding of said slider along, a respective zip track, an expansion element engaged to the body of said slider and disposed in the channel of said slider with which said female channel of said female zip track is located, said expansion element including a first and second distal end, said first distal end located at  
25 where said two channels of said slider merge as one, said second distal end located away therefrom, said first distal end of said expansion element being of a size expanding said female channel to a size larger than its steady state size, to hereby enhance the ease with

which said male profile can merge and demerge with said female channel as said slider moves in the longitudinal direction.

In a further aspect the present invention consists in a slider for merging and demerging male and female zip tracks of a kind which include a female zip track defining an elongate  
5 female channel and a male zip track defining an elongate male profile of a shape to be capturable in the female channel of said female zip track, said slider comprising;

a body defining a channel for each of said male and female zip tracks, said channels being separated save for their merging as one, at or towards one perimeter region of said slider, each said channel being of a profile to allow the capture by said channel, yet the longitudinal  
10 sliding of said slider along, a respective zip track,

an expansion element engaged to the body of said slider and disposed in the channel of said slider with which said female channel of said female zip track is located, said expansion element including a first and second distal end, said first distal end located at where said two channels of said slider merge as one, said second distal end located away therefrom, said  
15 first distal end of said expansion element being of a size expanding said female channel to a size larger than its steady state size, to hereby enhance the ease with which said male profile can merge and demerge with said female channel as said slider moves in the longitudinal direction.

In a further aspect the present invention consists in a garment incorporating a zip as  
20 hereinbefore described.

In a further aspect the present invention consists in an article of clothing incorporating a zip as hereinbefore described.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively,  
25 and any or all combinations of any two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

## DESCRIPTION OF DRAWINGS

A preferred form of the present invention will now be described with reference to the accompanying drawings in which:

- Figure 1 is a plan view of a slider for use with the zip of the present invention showing in part in phantom, the guide tracks for the male and female profiles and the expansion element,
- Figure 2 is an end view of Figure 1,
- Figure 3 is a view from the other (merged) end of Figure 1,
- Figure 4 is a perspective view of the profiles of the male and female zip tracks of the zip,
- Figure 4A is a front view of a garment incorporating the zip as herein described,
- Figure 5 is a plan view of the slider of Figure 1 engaged with the male and female zip tracks of Figure 4 shown at and towards a first distal end of the zip tracks,
- Figure 6 is a sectional view through the slider showing the location of the expansion element in the female guide slot,
- Figure 7 is a side view of the slider of Figure 1 and showing in part in phantom the guide track for the female profile zip track,
- Figure 7A is a sectional view through section AA of Figure 7,
- Figure 8 is a side view of the male and female zip tracks at and towards a first distal end thereof,
- Figure 8A is a sectional view through section AA of Figure 8,
- Figure 9 is a sectional view through section AA of Figure 7,
- Figure 9A is a sectional view through section EE of Figure 9,
- Figure 10 is a perspective view of the slider of Figure 1,

- Figure 11 is a perspective view of the male and female profiles of the zip of Example 2,
- Figure 12 is a perspective view of the slider of Example 2,
- Figure 13 is a an expanded end elevation of the female profile,
- Figure 14 is an expanded end elevation of the male profile,
- 5 Figure 15 is an expanded end elevation of the slider (reduced scale),
- Figure 16 is an elevation of the demerged end of the slider (reduced scale),
- Figure 17 top plan view of the slider of figure 16,
- Figure 18 is an end elevation of the merged (narrow) end of the slider of figure 16,
- Figure 19 is a cross-sectional view on line A-A showing the location of a “torpedo like”  
10 expansion means inside the slider (reduced scale),
- Figure 20 is a perspective view of segmented male and female profiles attached to a flexible tape with each profile having an integral flange extending along its length, and the last segment of the female profile cut away to show the location of the male segments which are out of step with the female segments,
- 15 Figure 21 is a cut-away perspective view of the expansion element of Figure 19,
- Figure 21a is a cross sectional view through figure 21 showing male and female guide slots and an expansion member in profile,
- Figure 22 is a perspective of the slider and pull tab,
- Figure 23 is a perspective of a partly segmented cup shaped female profile and a solid  
20 continuous part cylindrical male profile,
- Figure 24 shows partly split tracks,
- Figure 25 shows an interior plan view of a slider with an alternative more wedge shaped expansion element,
- Figure 26 is a cut-way perspective view of the slider and expansion element of Figure 26,

- Figure 27 shows a lower end stop attached to a male track,
- Figure 28A shows a latch and panel arrangement to lock the lower ends of the zip together,
- Figure 28B shows their location at the bottom of a jacket type zip,
- Figure 29 is an expanded front elevation of the latch and pawl locked together,
- 5 Figure 30 shows a zip with two sliders, and
- Figure 31 shows a modified partly segmented male track.

#### EXAMPLE 1:

This example deals with a zip 101 and slider 115 which are provided as an alternative to a zip of  
10 a toothed kind which may be incorporated in garments, articles of clothing, bags, clothing  
accessories or other.

ZIP TRACKS - The zip 101 consists of longitudinal zip tracks 102 and a zip slider 115.  
With reference to Figure 4 the zip tracks 102 of the present invention are each  
substantially of a constant cross section along their entire length. The zip tracks 102 form  
15 part of or are secured to portions of a garment which are to have the ability of being  
connected and separated by the zip 101 of the present invention.

For example where the zip 101 of the present invention is incorporated in a jacket having an  
anterior positioned opening, the zip 101 may be incorporated to the two front panels of the  
anterior portion of the jacket to allow for the jacket to be opened and closed to provide an  
20 open end (jacket type) zip.

MALE AND FEMALE TRACKS - The zip track 102 consists of a male zip track 103 and a  
female zip track 104. The male zip track 103 is primarily defined by its functional feature  
being a continuous flexible male profile 105 which is capable of merging and demerging with  
the continuous flexible female profile 106 of the female zip track 104 in a slider. A suitable  
25 flexible material such as a plastics material is used for the purposes of defining the profile 105,  
106 of the zip track 103, 104. The material of the profiles 105 and 106 may also be resilient if  
the zips are to be allowed to stretch along their length.

Each of the profiles 105, 106 are defined along a longitudinal edge 107 of a flange 108, 109 of the male zip track 103 and female zip track 104 respectively. Each flange 108, 109 is provided for the purposes of allowing the male zip track 103 and the female zip track 104 to be incorporated in a garment. The flanges 108, 109 are provided for the purposes of  
5 securing by stitching, ultrasonic welding, adhesive welding or the like to components of a garment.

The male zip track 103 and the female zip track 104 may be made from two separate items being the profiled features 105, 106 and the flanges 108, 109.

Alternatively the male zip track 103 and the female zip track 104 may each be made as a  
10 unitary item. The zip tracks 103, 104 are conveniently formed by injection moulding the profiles about a tape, in a manner similar to the production of conventional toothed zips. Most garment zips are made to defined lengths and so can be injection moulded.

Since the cross section of the male zip track 103 and the female zip track 104 are substantially constant along their entire longitudinal (in direction LL) length, extrusion of the zip  
15 tracks 103, 104 is also an appropriate manner for their manufacture. In which case partial slots or gaps (which are described below) may be formed in the male zip track, after their being extruded to improve flexibility and or stretchability. Extruded profiles would be cut to length and assembled with a slider and end stops.

SHAPE OF PROFILES - In this example the female profile 106 and male profile 105 are of a cup  
20 and ball shape. However alternative configurations of such profiles are also envisaged and the best profile that we have tested is that described in Example 2. It is a more oval or elliptical profile.

The female profile 106 includes a slot 110 which extends also in the longitudinal direction LL along the length of the female zip track 104. The slot is provided for the purposes of allowing  
25 the passing of the male profile 105 therethrough for the purposes of merging and demerging the male and female profiles 105, 106. The interior of the female profile 106 is preferably of a shape complementary to the shape of the male profile 105 although this need not necessarily be so. Indeed as long as the interior and cross sectional shape of the female profile 106 is of a size larger than the male profile 105, then the male profile 105 can be comfortably  
30 received within the interior portion of the female profile 106.

## WATER BARRIER

To achieve a water or fluid barrier across the length of the zip, i.e. to prevent water passing at right angles across the closed zip, it is desirable that the male and female profiles are of very similar cross section i.e. the cross section of the male profile corresponds very closely to the interior cross section of the female profile so that the female profile when merged with the male profile will tightly grip the male profile minimizing the risk of capillary action with water or fluids attempting to enter the slot of the female profile and traveling around the circumference of the male profile to exit on the other side of the slot.

As shown in Figure 4, both the male profile and the female profile are securely attached to a tape or flange 108, 109. This tape or flange should be formed of a waterproof or fluid resistant material. In most cases depending upon flexibility, it will be preferable to form 108 and 109 as integrally moulded flanges, of a plastics material, optionally the same plastics material as that of the male or female profiles. The flanges can be seam welded to a garment for example. The material, width, and thickness of these flanges 108, 109 will influence the flexibility of the male and female profiles as they move through the slider. As will be apparent from Figure 1, both the male or female profiles pass around respective "S" bends during the merge or demerge process.

By suitably choosing the properties of the material, and the size and shape of the flanges, and/or by using a flexible substantially waterproof tape, the flexibility of the profiles can be selected so that the profiles will be able to move through the slider.

In some cases either the male profile or the female profile may be partially slit or partially segmented, to enhance its bendability or flexibility to enable it to pass through the slider. Such slots or segmentation can be strategically placed to minimize any loss of fluid-tightness of the zip when both tracks are merged.

It is preferable that for a waterproof or water resistant zip that only one of the profiles is partially segmented, in order to minimize the risk of water passing through the gaps or channels between the segments. If both profiles were segmented, then it will be necessary to ensure that when the zip was closed the segments of the male profile were out of sync with the segments of the female profile. While such a configuration is possible, and we

prefer that both the male and female profiles are continuous without breaks in order to provide a tight fit of the male profiles within the female profile and minimize the risk of water passing through the barrier achieved by the closed zip.

As shown in Figure 4 it is preferred that the female member has flats alongside the slot 5 110, these flats corresponding with and mating tightly against the flats on the corresponding tape side of the male profile 105. These flats help in resisting any force attempting to pull the profiles apart, such a force being exerted in a direction at right angles to line LL of Figure 4. This could occur where a garment is too tight, and the wearer stretches the fabric of the garment. Where such a force is applied to attempt to 10 pull the two profiles apart, it is preferable that the profiles nest together in a close fitting arrangement so that distortion of the female profile arranged with the male profile is minimalised, otherwise there may be a risk that water might be able to pass into the female profile, and pass around the circumference of the male profile directed from the other side of the closed zip.

15 SLIDER - In order to enhance the ease with which the merging of the male profile 105 with the female profile 106 can be achieved, the slider 115 is provided for the purposes of the merging and demerging of the male zip track 103 and female zip track 104. The slider 115 is an element which is graspable by the hands or fingers of a user and allows for the user to slide the slider in the longitudinal direction LL along the zip tracks 103, 104. It may have a pull tab 20 attached thereto for ease of use.

The slider 115 is engaged with both the male zip track 103 and female zip track 104. Such engagement is as a result of the capturing of the profiles 105, 106 within guide slots 116, 117 of the slider 115. The guide slots are of a cross sectional shape (in a direction lateral to the longitudinal direction LL) sufficiently large enough to receive the respective profiles of the 25 male zip track 103 and female zip track 104, yet confined enough for the purposes of preventing the profiles so captured within the guide slots 116 and 117 from separating from the slider in the transverse direction TT. The guide slot 116 for the female profile is in this example substantially of a circular (or one corresponding to the shape of the zip track profiles) cross section and likewise the guide slot 117 for the male profile is also of a 30 substantially circular cross section along its length. Each slot includes an opening 118, 119 which allows the passing of the flange 108 and 109 respectively therethrough. The slider moving

in the longitudinal direction LL along the zip track 102 manipulates the male zip track 103 and female zip track 104 relative to each other for the purposes of their merging and demerging.

At a first end 120 of the slider 115, the male and female zip tracks 103, 104 extend from the slider 115 in a separated condition. At a second end 121 of the slider 115, the male and female  
5 zip tracks 103, 104 extend from the slider 115 in a merged condition as for example shown in Figure 5 transition between the first and second ends 120, 121 of the guide slots 116, 117 occurs which results in the bringing together of the profiles 106, 105 as a result of the merging of the guide slots 116, 117.

Preferably the slider 15 is provided with a spreader element, which is described in further  
10 detail with reference to Example 2 below. Preferably also, the cross sectional area of the female guide slot 116 expands as the slot extends in from each end of the slider 115, refer to the curves 270 detailed in figure 4 which show this increase in cross sectional area of the female guide slot 116. This expansion, and subsequent reduction, in cross sectional area of the female guide slot 116, when traveling from one end of the slot to the other, corresponds  
15 to some extent to the location and geometry of the spreader element which is located within the same slot. The change in cross sectional area is designed to accommodate expansion of the female profile 106 as it passes through the female guide slot 116 and is expanded by the expansion element.

## 20 EXAMPLES OF DIMENSIONS

It will be appreciated that the drawings are mostly on an enlarged scale, in order to illustrate the shapes, and functioning of the various components making up the zip fastener of this example. The zip fastener of this example can be made in various shapes, sizes and lengths to suit the end use of the product. However to appreciate the relative size of the components, we have given the  
25 following dimensions based on a prototype zip fastener designed for clothing for a typical zip length from 100mm to 500mm. These dimensions are given purely by way of example only, and are not intended to be in any way limiting on the scope of the invention.

### Slider

Length 15mm

internal male track in slider = 2.25mm

Widest end 11.5mm                      internal female track in slider = 3.75mm

Narrowest end 8mm                      internal merged track in slider = 3.7mm

Pull tab: 20mm long by 8mm wide

Profiles:

5    Male profile height: 2.0mm                      Width at widest: 1.75mm

Female profile height: 3.0mm                      Width at widest: 2.75mm

#### EXAMPLE 2:

This example is similar to example 1; save that the male member is shaped more like an arrow  
10 head, and the female member is more triangular in shape. The zip 201 consists of longitudinal  
zip tracks 202 and a slider 215. With reference to Figure 11 the zip tracks 202 of the  
present invention are each substantially of a constant cross section along their entire  
length save for a series of gaps 280A. The zip tracks 202 form part of, or are secured to,  
portions of a garment which are to have the ability of being connected and separated by the  
15 zip 201 of the present invention. For example where the zip 201 of the present invention is  
incorporated in a jacket having an anterior positioned opening, the zip 201 may be incorporated  
to the two front panels of the anterior portion of the jacket to allow for the jacket to be  
opened and closed.

MALE AND FEMALE ZIP TRACKS - The zip track 202 consists of a male zip track 203  
20 and a female zip track 204.

The male zip track 203 is primarily defined by its functional feature being a male profile 205  
which is capable of merging and demerging with the female profile 206 of the female zip track  
204.

Preferably, at least the female profile 206 of the female zip track 204 is made of a material which  
25 is resiliently flexible. Depending upon the application a suitable plastics material or rubber  
material (or a composite of the two) may be used for the purposes of defining the female profile  
206 of the female zip track 204. Suitable plastics materials can include polyethylene and

polyvinylchloride. Other plastics can be used. Choice of plastic will depend on its properties and suitability for the end use, ease of moulding about a flexible tape, flexibility and stretchability as well as the desired tensile strength.

Each of the profiles 205, 206 are preferably defined along a longitudinal edge 207 of a flange 208, 209 of the male zip track 203 and female zip track 204 respectively. Each flange 208, 209 is provided for the purposes of allowing the male zip track 203 and the female zip track 204 to be incorporated in a garment. The flanges 208, 209 are provided for the purposes of securing by stitching, ultrasonic welding, adhesive welding or the like to components of a garment. The male zip track 203 and the female zip track 204 may be made from two separate items being the profiled features 205, 206 and the flanges 208, 209. Alternatively the male zip track 203 and the female zip track 204 may each be made as a unitary item. The zip tracks 203, 204 may be formed by extrusion, co-extrusion or be made by injection moulding. Since the cross section of the male zip track 203 and the female zip track 204 are preferably substantially constant along their entire longitudinal (in direction LL) length, extrusion of the zip tracks 203, 204 is an appropriate manner for their manufacture. The slots or gaps which are herein after described may be formed in one or both of the male and female zip track, after their being extruded.

SHAPE OF PROFILES – A profile we have tested is shown in Figures 13 and 14. The male profile 205 looks a little like an arrowhead but it has a rounded nose. Its leading edge is part of an ellipse. It has a pair of re-entrant flanges at rear. The female profile 206 includes a slot 210 which extends also in the longitudinal direction LL along the length of the female zip track 204. The slot is provided for the purposes of allowing the passing of the male profile 205 there through for the purposes of merging and demerging the male and female profiles 205, 206. The interior of the female profile 206 is complementary in shape to the shape of the male profile 205. The female profile provides a continuous (or semi-continuous) cavity of a cross-sectional shape corresponding to but slightly larger than the dimensions of the male profile.

The re-entrant nature of the jaws 211 of the female profile 206 co-acting with the flanges 212 of the male profile 205 in a 50 mm length of a first prototype had a tensile strength (resistance to being pulled apart at right angles to the length of the zip) of over 15kgs. This tensile strength can be varied by suitable design of the profile shapes and choice and flexibility of materials used in

the manufacture of the zip. In some cases a low tensile strength may be an advantage (for safety) in other cases a high tensile strength may be desirable.

Where both the male and female profiles are of a continuous and constant cross section along their entire length, then a water-resistant seal can be established between the male and female tracks 203, 204 as described above. The quality of the seal can be influenced by the plastics type used and the closeness of the fit between the profiles 205 and 206. However it is possible to still retain a waterproof seal whilst providing partial slits on one or other of the profiles. Figure 32 shows partial slits on the male profile, the slits stopping short of the base of the arrowhead so that when inserted into the female profile during the merging process, the base of the arrowhead and the co-acting jaws of the female profile prevents or minimizes the risk of water entering the interior of the female profile and passing through the zip.

These partial slits in the male profile will allow it to bend when passing through the slider.

Alternatively it is possible to provide partial slits on the female profile adjacent its jaws, or elsewhere on the female profile, depending on the type of bending required, whilst maintaining the male profiles as a continuous solid or hollow profile so that the possibility of water passing through the closed zip is minimized.

In a much less preferred arrangement it is possible although far less practicable to maintain a water seal and yet provide slits on both the male and female profile. If both male and female profiles are slit or segmented, then it is desirable to ensure that the segments are out of step with one another, and this can be achieved by suitable positioning of the male segments, and the provision of end stops at the top and bottom of the zip so that the two profiles can bend when passing through the slider, but ensuring that a slit or gap between the segments of the male profile do not match at any stage with the gaps or slits between the segments of the female profile. A number of the drawings illustrate slits or gaps between segments of the male and/or female profile, and it will be appreciated that the zips will be designed to minimize or eliminate the passage of water therethrough.

SLIDER - In order to enhance the ease with which the merging of the male profile 205 with the female profile 206 can be achieved, the present invention incorporates a slider 215 for the purposes of the merging and demerging of the male zip track 203 and female zip track 204.

The slider 215 (refer to Figure 22) has a pull tab 231 hingedly connected to an external boss 230 and is designed to be graspable by the hands or fingers of a user and allows for the user to slide the slider in the longitudinal direction LL along the zip tracks 203, 204. The slider 215 is engaged with both the male zip track 203 and female zip track 204. Such engagement is as a result of the capturing of the profiles 205, 206 within guide slots 217, 216 of the slider 215.

The guide slots are of a cross sectional shape (in a direction lateral to the longitudinal direction LL) sufficiently large enough to receive the respective profiles of the male zip track 203 and female zip track 204, yet confined enough for the purposes of preventing the profiles so captured within the guide slots 216 and 217 from separating from the slider in the transverse direction TT. The guide slot 216 for the female profile as shown in figure 15 is of a shape corresponding to the shape of the female profile 206 shown in figure 13. Similarly the guide slot 217 for the male profile is of a shape corresponding to the shape of the male profile 205 shown in figure 14.

It will be noted that the cross sectional area of the female guide slot is larger about the torpedo shaped expansion element 226 to allow for expansion of the female profile as described below. This is also evident in the modified slider 226A shown in Figure 25.

Figure 21a shows the male and female guide slots 216 and 217 and the expansion member 226 in profile, in a cross sectional view. It can be seen in this drawing that the bridge 228 attaches the expansion member 226 to the central island portion 227. The central island portion 227 is essentially the material of the slider 215 which is between the male and female guide slots 216 and 217. In this view the male and female guide slots 216 and 217 can be seen diverging as they extend away from the bifurcation area (not shown) towards the first end 220 of the slider 215.

Guide slot 216 may be straighter than guide slot 217, as the female profile because of its size and shape may be less flexible than the male profile and may depending upon design parameters be less able to accommodate as much of a bend within the slider guide track as would the male member. However in some cases it may be desirable to make the guide slots of the same length to minimize differential drag between the profiles and the slider which may result in twisting of the slider.

Each slot includes an opening 218, 219 which allows the passing of the flange 208 and 209 respectively there through.

The slider moving in the longitudinal direction LL along the zip track 202 manipulates the male zip track 203 and female zip track 204 relative to each other for the purposes of their merging and demerging. At a first end 220 of the slider 215, the male and female zip tracks 203, 204 extend from the slider 215 in a separated condition as shown in figures 20 and 30.

At a second end 221 of the slider 215, the male and female zip tracks 203, 204 extend from the slider 215 in a merged condition as for example is shown in Figure 20. A transition between the first and second ends 220, 221 of the guide slots 216, 217 occurs which results in the bringing together of the profiles 205, 206 as a result of the merging of the guide slots 216, 217. Hence extending from the second distal end 221 where the guide slots 216 and 217 are merged, towards the first distal end 220, the guide slots 216 and 217 bifurcate.

Extending immediately along the guide slot 216 for the female profile beyond the region 225 thereof where bifurcation is initiated the guide slot 216 for the female profile incorporates a torpedo like expansion element 226.

The expansion element 226 is disposed within the guide slot 216 in a region thereof immediately adjacent to the bifurcation initiation zone 225. The expansion element 226 is an elongate element extending in the direction of the guide slot 216. The expansion element 226 is of a profile which at least immediately adjacent the bifurcation zone 225 results in the expansion of the slot 210 to the extent that it opens sufficiently to receive and allow the passing there through of the male profile 205 of the male zip track 203. The cross section of the expansion element 226 corresponds to the cross section of the female profile. The shape of the expansion element is shown in more detail in figure 21.

This expansion initiated by the sliding of the slider 215 in a direction advancing the first distal end 220 as the leading edge of the slider 215, will result in the progressive traveling of the expansion element 226 along and within the female profile 206 and as the female profile 206 passes over the expansion element 226 the female profile 206 is opened to

expand the slot 210 sufficiently to allow the male profile 205 to pass there through with a reduced requirement for the pressing of the male profile 205 into the slot 210. In the most preferred form the slot 210 is opened to a size slightly larger than the thickness of the male profile 205 so that no pressing of the male and female profiles 205, 206 together is necessary to establish a merged condition therebetween.

The expansion element 226 is of a tapered nature extending from its widest point at or near the bifurcation zone 225, to a bullet shaped end 229 towards the first distal end 220 of the slider 215. Such a tapered profile will allow for the gradual expansion of the female profile 206 as the slider is advanced in the direction to merge the male and female profiles 205, 206.

10 The expansion element 226 is attached to a central island 227 of the slider by a bridge member 228, see figure 21. The bridge 228 is of a size which allows it to pass through the slot 210 of the female profile 206.

In the most preferred form of the present invention the guide slot 216 for the female profile 206 is not of a constant cross section along its length between the first distal end 220 and at least the bifurcation zone 225. Most preferably the guide slot 216 expands from a smaller cross section at the first distal end 220 to a slightly larger cross section where the expansion element 226 is provided.

Such expansion can be seen for example with reference to Figure 9A. The expansion of the guide slot 216 is commensurate with the expansion in the shape of the female profile 206 as it progresses along the guide slot 216. Whilst a constant cross section of a shape commensurate with the female profile when in a fully expanded condition may be appropriate along the entire length of the guide slot 216, it is preferred, and in order to ensure that the female profile remains well captured within the guide slot 216, that the cross section does vary over the length of the guide slot 216.

25 In order for contact to be maintained by the expansion element 226 with the female profile 206 over a distance for as long as practically possible prior to the merging of the female profile with the male profile, it can be seen that the expansion element 226 extends at least in part into the path of the male profile defined by the guide slot 217.

The end of the expansion element 226 nearest the second end 221 preferably includes a cut out 238 which is of a shape to allow the passing, there adjacent of, of the male profile 205. However once the male and female profiles are merged substantially in the merged zone 239 of the then non-bifurcated guide tracks 216, 217, no influence of the expansion element 226 is necessary for the female profile 206. It will be appreciated that whilst in a majority there has been reference made herein to the merging of the male and female profiles, a demerging of the male and female profiles operates in substantially the reverse manner to that which has herein been described, i.e the spreader expands the female profile 206 away from the male profile 205 in the area where the guide slots 216 and 217 bifurcate.

#### DEMERGING

When the zip is closed the top of the male and female profiles will extend from the first end 220 of the slider (in that sense a jacket zip is never fully closed as a small portion of the male and female profiles will always be unmerged – unlike the face to face seals inside zip lock plastic bags. Consequently downward movement of the slider along the zip will cause the male and female profiles to pass through the guide slots and demerge whether or not there is an expansion element in the female guide slot. Nevertheless by suitable shaping of the end of the expansion element facing end 221 it is possible to assist the demerging operation and help the female profile to open up as it moves away from the male member where the guide slots separate. By suitably spacing the shaped expansion element away from the side of the guide track by a thin bridge it is possible for the jaws of the female profile to fit around the bridge portion as it relaxes into the demerged state, so that the bridge portion is thin enough to pass through slot 210 of the female profile.

In the demerging of the male and female profiles, the advanced most edge of the slider is the second end 221. The slider 215 will always remain in contact with the male and female guide tracks 203 and 204 and when the zip tracks 202 are in a fully merged condition along substantially their entire length, the slider will be provided at the upper end of the zip tracks 202.

The slider is preferably injection moulded from a low friction plastics material, such as PTFE (polytetrafluoroethylene), to allow ease of movement of the slider and the insertion of the expansion element into the female profile.

Another form of expansion element is shown in Figures 25 and 26. It is a sharper wedge shape designed to penetrate the slot and interior of the female profile and allow it to expand sufficiently to snap over the male profile.

End stops may be provided on the zip tracks to prevent the slider 215 from sliding  
5 beyond and off the zip tracks 202. Progression of the slider 215 towards the other end of the zip tracks 202 will result in the male and female profiles 205, 206 demerging.

#### CLOSED END ZIPS.

If the zip fastener is intended as a closed end zip such as a trouser zip (or a bag zip), one end of the two profiles can be joined together in a suitable fashion typically by sewing in  
10 a similar fashion to prior art zippers. End stops may be provided at the other end (top) of the profiles to trap the slider on at least one of the profiles. In most cases this will be the female profile.

#### OPEN END ZIPS (Jacket type zips)

Where the two profiles are not joined together to allow full separation as is the case with  
15 a jacket type zip then end stops can be provided at each end of the zip profiles. Preferably at least one end of the profiles has means for locking the zip tracks together to prevent longitudinal movement of the male track sliding within and then out of the female track when the zip is closed.

Any type of end stop can be used to keep the slider on the tracks and align the two ends  
20 of the zip tracks. Conventional lower end stop designs can be used. A novel end stop will now be described. This end stop design is a "locator" and is designed to stop longitudinal movement of the male and female tracks relative to one another.

#### LOWER END STOPS

Since the male and female zip tracks 103, 104 are of a kind which are of generally uniform  
25 or repeating profiles along their length, the zip tracks provide no resistance beyond that provided as a result of friction, to longitudinal sliding relative to each other in the direction LL.

Where the zip 101 is to be incorporated in for example a jacket, a complete separation of the zip tracks needs to be capable of being provided. As such it is not possible to permanently lock the male and female zip tracks 103, 104 together at for example one of the ends of the tracks (as is the case with closed zips such as trouser zips).

- 5 A temporary means of fastening the tracks to prevent their relative movement in the longitudinal direction is however desired so that the garment can remain in alignment.

One way of achieving this is to incorporate at one end of the zip track 102, a zip stop 160 as shown in Figure 29. The zip stop 160 consists of a latch 168, and a pin box 161 which may be of a kind similar to those found on tooth like zip tracks (we have used the term “pin  
10 box” to designate this part as it appears in a similar location to the pin box of a conventional toothed zip fastener but our pin box performs a different function and is of a different shape.

The pin box 161 is incorporated at the end of one of the male and female zip tracks 103, 104 (preferably to the female zip track 104 as shown in Figure 28A) and extends in a  
15 manner therefrom to present an interference to the movement of the male zip track 103 in the longitudinal direction advancing it beyond the end 162 of the female zip track 104. It may also incorporate a slot 165 or rebate or recess for the purposes of receiving the distal end 166 of the male zip track 103.

The slot 165 is provided in a configuration to discourage or prevent the separation of the  
20 male zip track 103 from the female zip track 104 in a direction transverse to the longitudinal direction LL.

The distal end 166 of the male zip track 103 is hence captured and prevented from movement in a direction transverse to the longitudinal direction LL once received within the slot or recess 165. The slot or recess 165 is of a shape which includes a region  
25 commensurate with the male profile 105 of the male track 103 and includes an opening to exterior thereof, through which the flange 108 of the male zip track can pass. With the provision of the pin box 161 to one of the male and female zip tracks 103, 104, movement of the male and female zip tracks in one direction of the longitudinal directions LL is able to be prevented.

However without any further enhancement, it is still possible for relative movement in an opposite direction along the axis LL to occur between the male and female zip tracks 103, 104. This direction would be to separate the engagement of the end 166 of the male zip track 103 from within the slot 165 of the pin box 161.

- 5 In order to prevent the movement of the male zip track 103 in that direction, the male zip track 103 is provided with a latch 168 which is capable of being located with a catch 169 of for example the pin box 161. The latch 168 includes a surface for mutual engagement with a surface of the catch 169 when the distal end 166 of the male zip track 103 is located adequately or to its full extent, within the recess 165 in its longitudinal direction LL.
- 10 The catch 169 becomes engaged with the latch 168 in a manner to prevent the retraction of the distal end 166 from the slot 165 of the pin box 161. The arrangement of the latch 168 and catch 169 is preferably for it to act in a snap fit like manner. As the male zip track 103 is advanced for the engagement of its distal end 166 within the slot 165 by its movement in the direction LL relative to the female zip track 104, the catch 169 is also advanced in
- 15 the direction LL until its alignment with the catch 169 whereupon it will snap into an interference relationship therewith.

- The catch 169 includes a profiled surface 170 which is provided for the purposes of allowing for the catch 169 to be displaced in a direction transverse to the longitudinal direction LL as it is progressed for engagement of the distal end 166 into the slot 165. The
- 20 profiled surface 170 is for example a tapered or curved surface which presents no significant resistance to its movement and the movement of the male zip track 103 in the longitudinal direction to establish an engagement of the distal end 166 within the slot 165. The latch 168 is hence made from a resiliently flexible material which is capable of moving in the direction transverse to the direction LL so as to allow for it to be advanced and establish the
- 25 interference like fit with the catch 169 of the pin box 161.

- To allow for the disengagement of the latch 168 with the catch 169, the latch 168 includes a graspable end 171 presented to allow for a finger of a user to manipulate the latch 168 for the purposes of its disengagement with the catch 169. The end 171 is hence presented to allow for the displacement of the latch 168 by a finger of the user in a direction transverse to the
- 30 longitudinal direction LL to slide the interference surfaces of the catch 169 and latch 168 to thereby allow for the male zip track 103 to remove itself from engagement with the slot 165.

The end 171 of the latch 168 protrudes or projects sufficiently for convenient grasping or at least engagement by a finger of a user for the purposes of allowing the disengagement of the latch 168 with the catch 169. Whilst in the most preferred form and as herein shown, the pin box 161 is provided at the end of the female zip track 104, it may alternatively be provided at the end of the male zip track 103 and the latch 168 may be provided to the female zip track.

The size and shape of this end stop 160 allows for the placement of a hole 190 passing through the pin box 161 for attachment of a ski pass or other ticket or identification tag.

In order to enhance the ease with which the merging of the male profile 105 with the female profile 106 can be achieved, the present invention may incorporate a slider 115 for the purposes of the merging and demerging of the male zip track 103 and female zip track 104.

The slider 115 is an element which is graspable by the hands or fingers of a user and allows for the user to slide the slider in the longitudinal direction LL along the zip tracks 103, 104. The slider 115 is engaged with both the male zip track 103 and female zip track 104. Such engagement is as a result of the capturing of the profiles 105, 106 within guide slots 116, 117 of the slider 115.

The guide slots are of a cross sectional shape sufficiently large enough to receive the respective profiles of the male zip track 103 and female zip track 104, yet confined enough for the purposes of preventing the profiles so captured within the guide slots 116 and 117 from separating from the slider in the transverse direction TT. The guide slot 116 for the female profile is substantially of a part elliptical cross section and likewise the guide slot 117 for the male profile is also of a substantially part elliptical cross section along its length so that they correspond to the shape of the two profiles.

Each guide slot 116 and 117 includes an opening 118, 119 which allows the passing of the flange 108 and 109 respectively therethrough. The slider moving in the longitudinal direction LL along the zip track 102 manipulates the male zip track 103 and female zip track 104 relative to each other for the purposes of their merging and demerging. At a first end 120 of the slider 115, the male and female zip tracks 103, 104 extend from the slider 115 in a separated condition. At a second end 121 of the slider 115, the male and female zip tracks 103, 104 extend from the slider 115 in a merged condition

as for example shown in Figure 5. A transition between the first and second ends 120, 121 of the guide slots 116, 117 occurs which results in the bringing together of the profiles 105, 106 as a result of the merging of the guide slots 116, 117.

5 The opening for the tracks at end 121 of the slider is optionally off-set from its centreline to allow the latch 168 to pass external of the slider. To prevent a clashing of the latch 168 with the slider the latch is also off-set from its male track 105 by a distance X as shown in figure 29 and is preferably attached to the tape or flange of the male profile so that it can bypass the slider when the end of the male profile is inserted into the slider.

10 The gap between the end of the male track 105 and the latch 168 is sufficient to allow the slider 115 to pass there through.

PARTIAL SLITS – Figure 23 shows a modification to the zip fastener of Figure 4. In this case the male profile 105A is a solid continuous part cylindrical extrusion similar to that of Figure 4, with gaps or relief slots 180A on the portion of the female profile opposite the flange 109A.

15 However the cup shaped female profile has slits 180A extending part way through the flat face adjacent the slot 110A to enhance flexibility of the female profile. To enhance water resistance the slot should be as small as and as infrequent as possible, but to enhance flexibility more and deeper slots are preferred. It is thus a matter of balancing up the objective of flexibility versus the water resistance of the closed zip to achieve the best balance in product. Either the male profile or the female profile may be slitted or partly segmented. We prefer not to fully segment  
20 both of the profiles as this may lessen the water resistance of the closed zip, unless special care is taken to ensure that the slits of the male and female profiles are out of sync with one another and are spaced far apart in order to reduce the likelihood of capillary flow within the confines of the female profile. Figure 31 shows an arrangement in which the male profile is partly slit and the female profile is continuous.

25 With reference to Figure 24 there is shown a modification to the otherwise constant cross section female profile 206A. In this instance there are slots 280A formed not entirely through the female profile. The slots 280A are provided in the female profile with a view to weakening its bending moment strength in a direction normal to the plan of the flange or tape 209 for the enhancement of the flexibility of the female zip. If the slots or slits are also provided in the male profile they  
30 may only be shallow slits or grooves. The female profile is weakened to allow for easier bending

in a plane extending longitudinally and perpendicular to the plane of the flange 209. It will be appreciated that in this configuration, the material of the female profile will be influential in the nature of the stretchability of the female zip track since the female profiles are not separated elements. If the male profile has slots, then the female slots will be offset or out of synch with the slits in the male profile to minimize leakage across the closed zip.

ELLIPSOIDAL MALE SEGMENTS – With reference to Figure 31 there is shown a modification to the shape of the male segments 305. In this version the segments are generally ellipsoidal in nature. By rounding the ends of the male segments 205 it is possible to allow for larger gaps between both the male and female segments to enhance stretchability and flexibility whilst minimizing the risk of the leading edge of the male segments 305 from catching in the gap 380 between the female segments 306.

Although we prefer to manufacture the male and female segments from a plastics material it is possible (though unlikely) that the male segments (especially these ellipsoidal segments 305) could be made of metal and crimped onto the tape.

15

#### EXAMPLES OF DIMENSIONS

It will be appreciated that the drawings are mostly on an enlarged scale, in order to illustrate the shapes, and functioning of the various components making up the zip fastener of this example. The zip fastener of this example can be made in various shapes, sizes and lengths to suit the end use of the product. However to appreciate the relative size of the components, we have given the following dimensions based on a prototype zip fastener designed for clothing for a typical zip length from 100mm to 500mm. These dimensions are given purely by way of example only, and are not intended to be in any way limiting on the scope of the invention.

#### Slider

25	Length 15mm	internal male track in slider = 2.5mm
	Widest end 11.5mm	internal female track in slider = 4mm
	Narrowest end 8mm	internal merged track in slider = 4mm

Pull tab: 20mm long by 5mm wide

Profiles:

Male profile height: 2.5mm

Width at widest: 2.0mm

Female profile height: 3mm

Width at widest: 3.0mm

5

#### INDUSTRIAL APPLICATION

The invention relates to a novel water resistant zip fastener particularly suited for use in the manufacture of clothing, as well as for bags and footwear.

By forming the male or female tracks of constant but complementary cross sections, the female profile can tightly grip and retain within it the male profile to thereby create a fluid resistant barrier across the closed zip. This can be enhanced by forming the male and female profiles about waterproof tapes. Indeed it is possible to co-extrude the male and/or female profile about or integral with a web or flange forming a waterproof tape. Similarly the female profile could be extruded in one piece with an extending waterproof flange flexible enough to function as a tape for attachment to a garment, or it could be co-extruded with a suitable waterproof tape.

Depending upon the nature of the plastics materials used, and the tolerances, the female profile can be made to grip tightly about the male profile and if made from a water repellent material, the likelihood of water penetrating the interior of the female profile is minimal and thus suitably engineered the zip of these examples could be formed as a fluid tight seal, particularly useful for wetsuits, and chemical safety clothing.

#### ADVANTAGES

The novel zip fasteners of these examples are designed to prevent a fluid or water barrier to water passing across the barrier created by the merged zip. Such a fluid tight or fluid resistant zip can be used in wet weather gear, chemical safety clothing, and in any other application where it is desirable to prevent the leakage of water into or out of a container, or across a barrier. Wet

25

weather clothing may involve the use of additional flaps, special fittings at the ends of the zip, and other means to prevent the passage of water through the garment.

The various zip fasteners described in the examples and illustrated in the drawings provide ways of conveniently and easily fastening clothing in a manner readily understandable to the users familiar with conventional zips, whilst at the same time providing a flexible fastener which  
5 minimizes the risk of fluid passing through the fastener because of the continuous or semi-continuous nature of the male and female profiles. This invention can be applied to various types of zip fasteners, with one or two or more sliders and can be made in any convenient size or shape.

10 The expansion element in the slider allows the female profile to be opened and slid over the male profile without excessive force and without the need to apply force to close the female profile. The resilient nature of the female profile will allow it to spring back into its resting state and close about and retain the male profile trapped inside after merging has taken place.

The male and female profiles may be formed from different materials or have different  
15 properties. They can be injection moulded about reel fed tapes. The relative size and relative friction or stiction of the male and female profile may be such that once merged relative sliding of the two profiles is difficult so that the tracks are held in place. Or end stops can be used to anchor at least one end of the tracks to prevent relative sliding of the tracks.

The continuous nature of the new zips described herein can provide less drag than, for example a  
20 toothed zipper. This feature could be significant especially for zips used on clothing for athletes who require minimum drag, for example swimmers, skiers and triathletes.

The prior art zips have to either be soft enough to allow for the profiles to slip into place without requiring significant force to push the profiles together but this simultaneously limits or reduces the resistance to the lateral separation of the tracks.  
25 Should the strength of the material be enhanced, then despite the fact that the resistance to lateral separation will be increased, the longitudinal stiffness of the zip will also increase. Where a zip is incorporated in a garment it is desirable for the longitudinal stiffness to not be so significant as to alter significantly, the appearance of the garment or to make its use or comfort more limited or reduced.

## VARIATIONS

Whilst we have illustrated two different configurations of male and female profiles, it will be appreciated that a number of different, and preferably complementary shapes could be used for the male and female profiles, depending upon the degree of tensile strength required when a force is applied to either side of the zip fastener to pull it apart, as well as the resilience of the zip fastener and the profiles thereof to accommodate bending or flexing transversely to the main axis of the zip fastener. As for example when the fabric is pulled or pushed at right angles to the longitudinal axis of the zip, or the components of the zip fastener pass through the slider to merge or demerge. The size of shape of the male and female profiles, the design properties of the materials used, for example the type of plastics used, and the way that the profiles are formed either by injection moulding, or by extrusion, or by some other process, can be varied through different applications, production volumes, or different designs of a zip fastener for particular purposes.

The male profile may be hollow instead of solid, to enhance its flexibility.

Although in the main examples we have mentioned the use of plastics material for the different profiles, it is equally possible that the profiles could be formed of a natural or synthetic rubber, e.g. neoprene rubber or the like, and could be moulded about a resilient tape, the flexible or resilient tape preferably having the similar stretch characteristics as the fabric to which it is to be attached. Although we have mentioned polyethylene and polyvinylchloride as preferred plastics materials for the male and female profiles, it will be appreciated that there are various other plastics materials may be used depending upon the application, for example the components could be formed of nylon, polytetrafluoroethylene (PTFE), low density polyethylene (LDPE), high density polyethylene (HDPE) and various other industrial plastics.

Although the water resistant zip is best made by injection moulding the profiles onto a supply of tape, it is possible that by using a resilient plastics or rubber material for the male and female profiles that a water resistant zip could be made by extrusion or co-extrusion.

Although in most cases the slider will be made from a hard plastics material, it is also possible to make all or part of the slider from other materials and in particular from metal. The slider for use with the profiles of this invention typically has a shallower entrance angle than conventional sliders used with toothed zips where the teeth have to be meshed together.

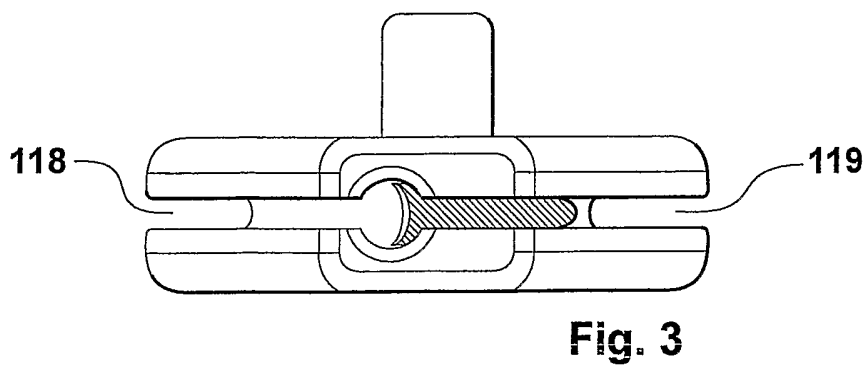
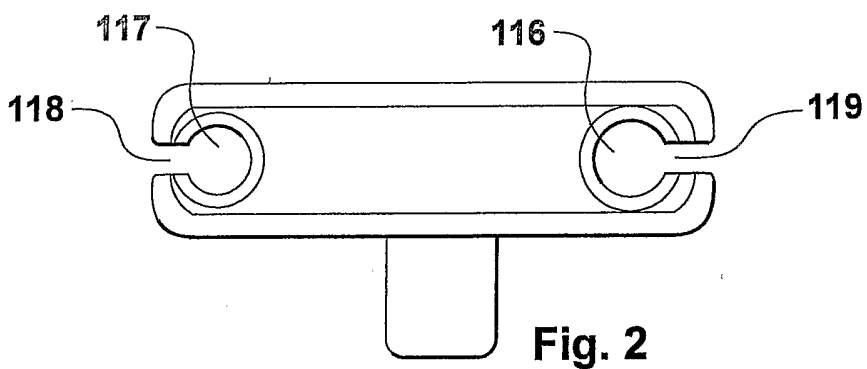
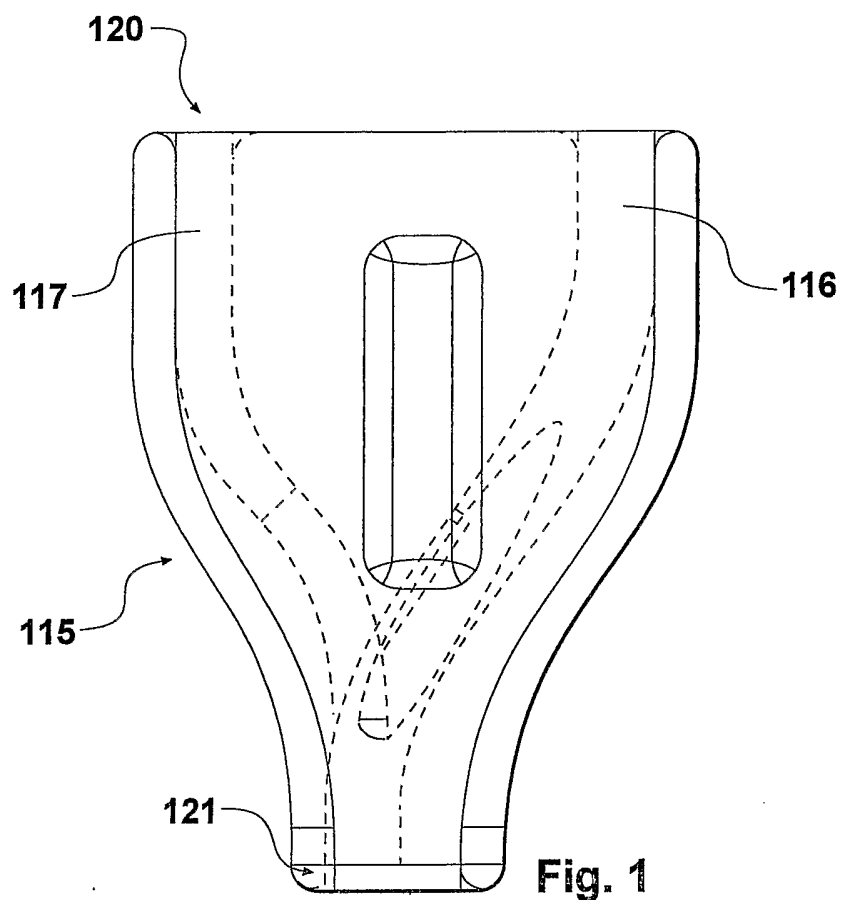
Finally, it will be appreciated that various other alterations or modifications may be made to the foregoing without departing from the scope of this invention.

## CLAIMS

1. A fluid resistant zip for use on wet suits, wet weather clothing, bags, safety wear and sports equipment, said zip comprising two mutually engagable zip tracks, each track attached to or integral with a tape, and a slider capable of moving along the zip tracks to merge or demerge the tracks, wherein a first of said zip tracks has a female profile defining a slotted cavity with the slot extending along the length of the zip; and a second of said zip tracks has a male profile capable of fitting within and being closely held by the female profile; and wherein at least the female profile is of uniform cross section along its length to present a barrier to fluids when the zip is closed.  
5
2. A zip as claimed in claim 1, wherein the slider has guide means within the slider adapted to guide the male and female profiles towards one another for merging,  
10
3. A zip as claimed in claim 2, wherein there is an expansion element within the slider adapted to open the slot of the female profile sufficiently to allow the female profile to fit over and capture the male profile so that the two tracks are merged together into a closed state,  
15
4. A zip as claimed in claim 3, wherein the male profile is segmented or partly segmented along its length to increase its flexibility.
5. A zip as claimed in claim 3, wherein the male profile is of uniform cross section along its length.
- 20 6. A zip as claimed in claim 3, wherein each track is formed by extrusion or co-extrusion.
7. A zip as claimed in claim 1, wherein the tape is formed of a waterproof material.
8. A zip as claimed in claim 6, wherein the male profiles are generally cylindrical and the female profiles are generally C-shaped in cross section.
- 25 9. A zip as claimed in claim 2, wherein the male profile is generally wedge shaped with the tape attached to the base thereof, and the female profile is of a complementary wedge shape with a slot along the base of the female wedge shape and the tape attached to the apex of the female wedge shape.

10. A zip as claimed in claim 9, wherein the guide means includes a male slot adapted to allow passage of the male profile therethrough, and a female slot adapted to allow passage of the female profile therethrough, the male and female extending from an entrance end of the slider towards one another and towards a merged slot which exits from the other end of the slider track.
- 5
11. A zip as claimed in claim 10, wherein an expansion element is located in the female slot and has a tapered portion facing towards the entrance end so that it can be located in the cavity of the female profile.

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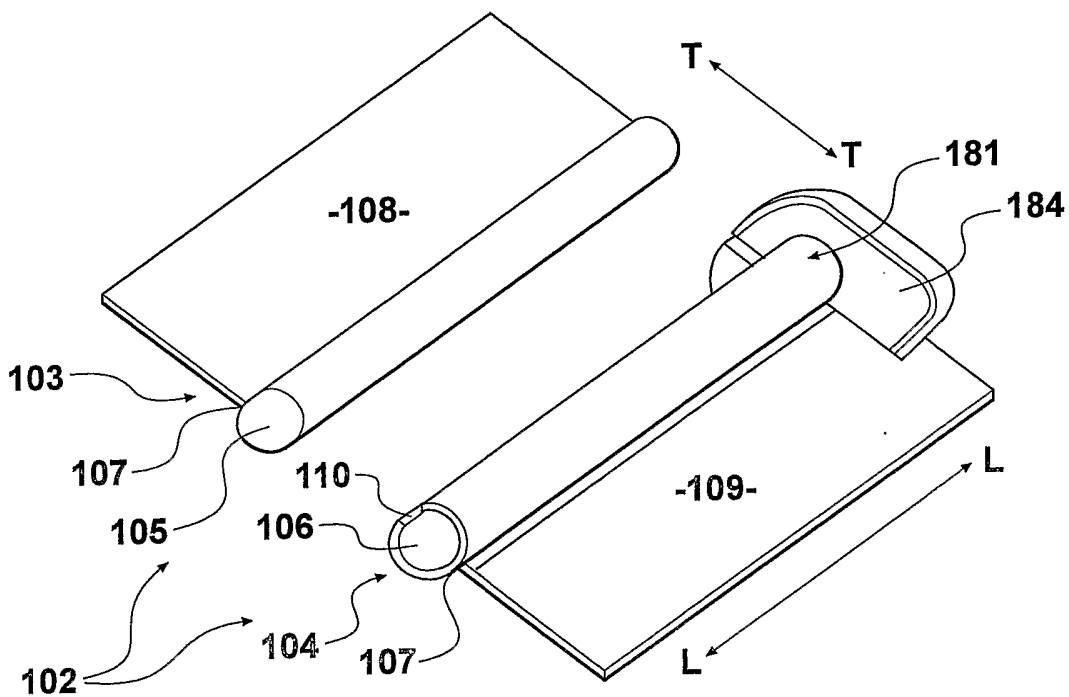


Fig. 4

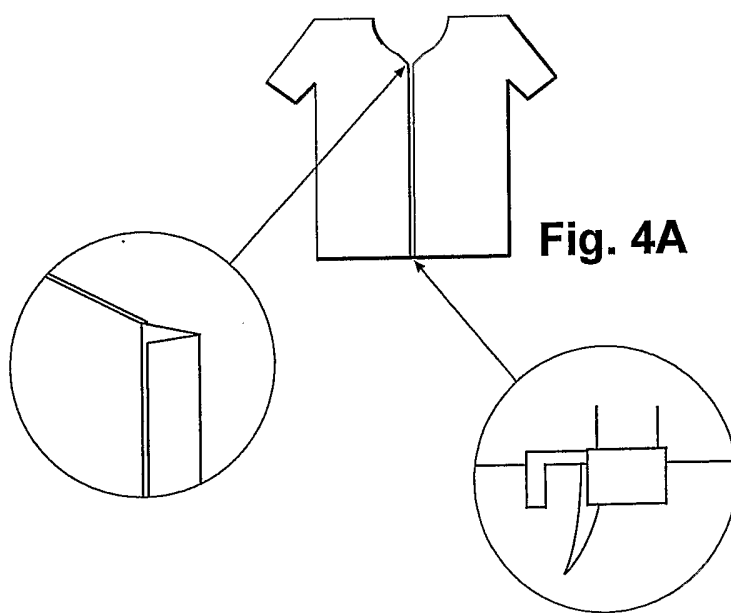


Fig. 4A

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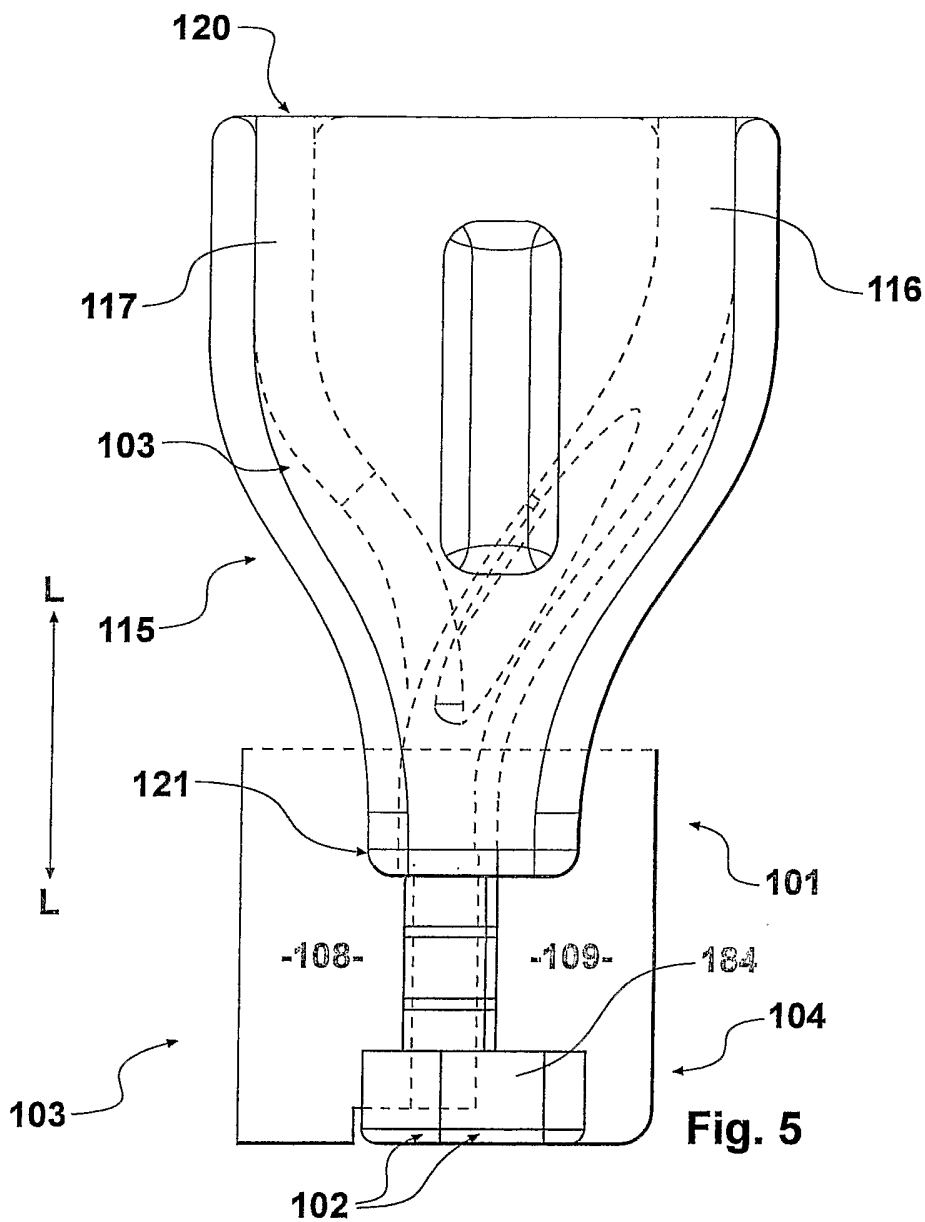


Fig. 5

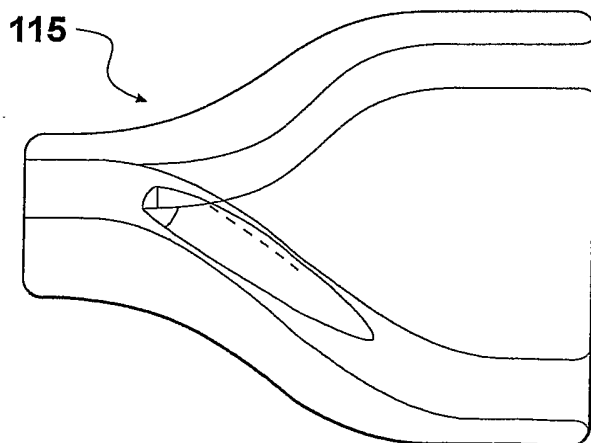


Fig. 6

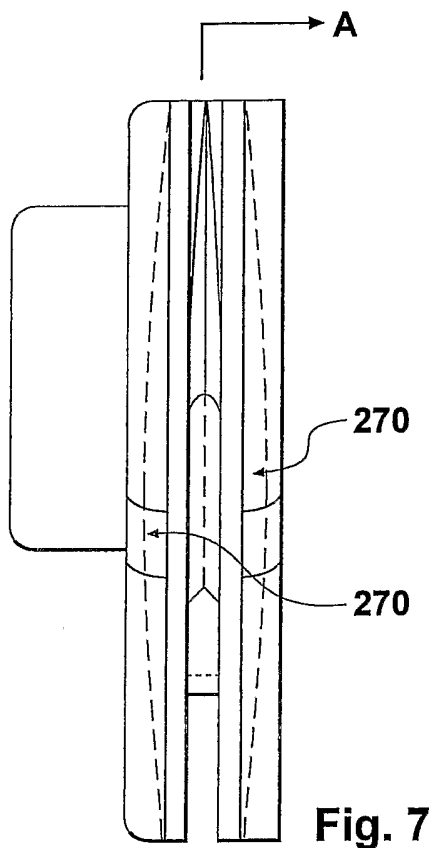


Fig. 7

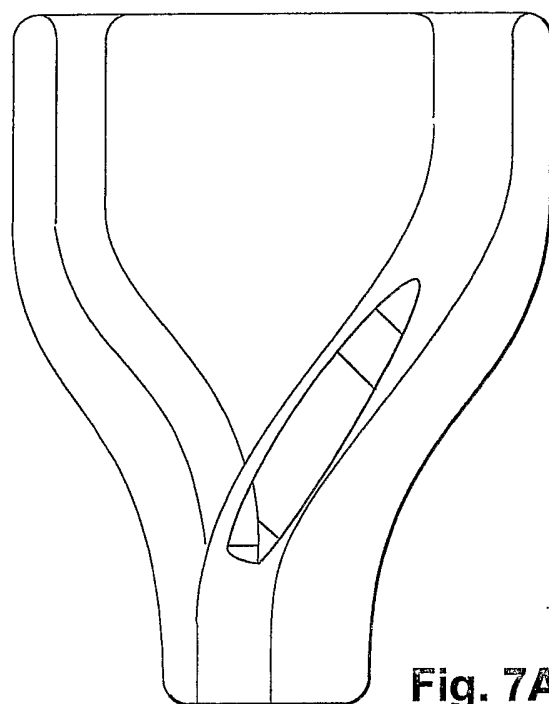


Fig. 7A

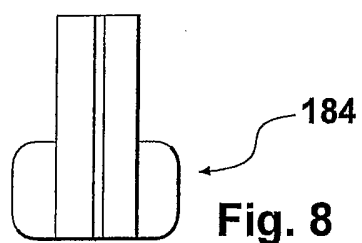


Fig. 8

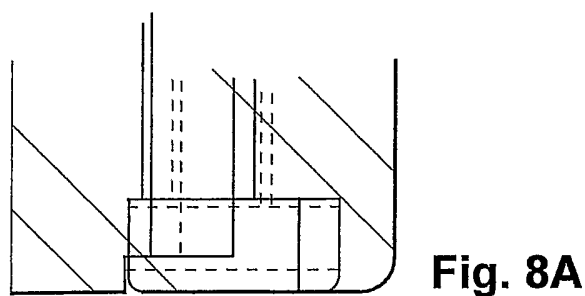


Fig. 8A

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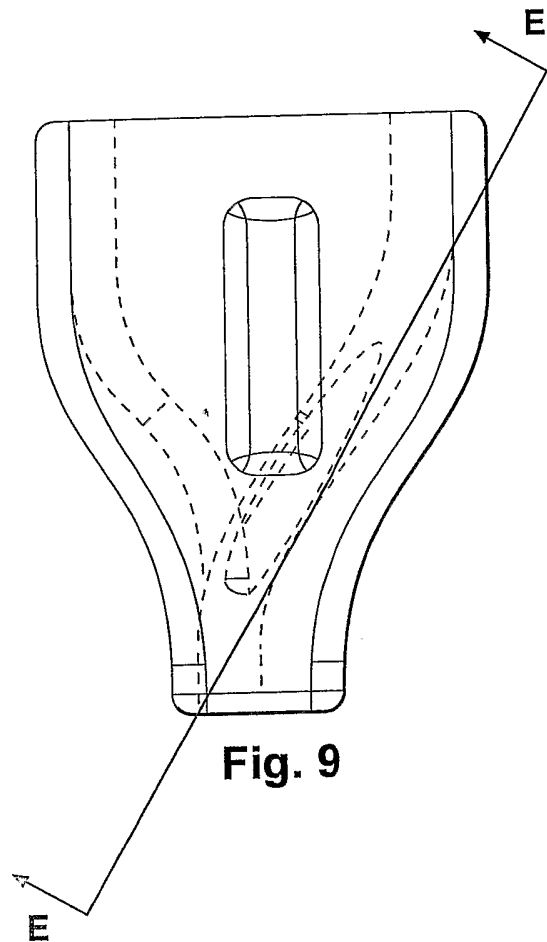


Fig. 9

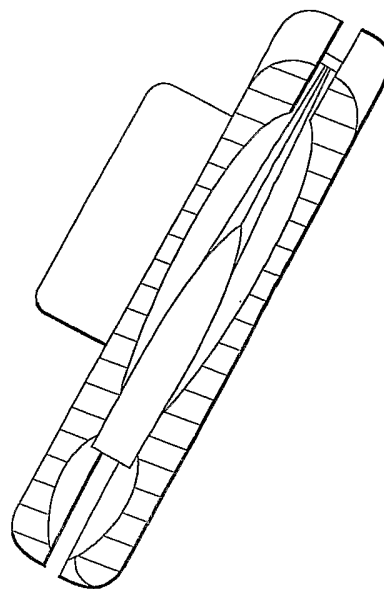


Fig. 9A

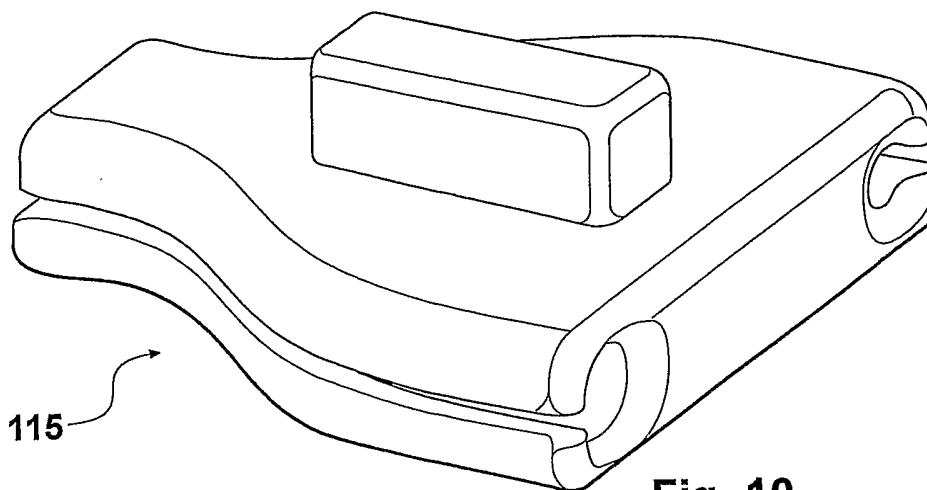


Fig. 10

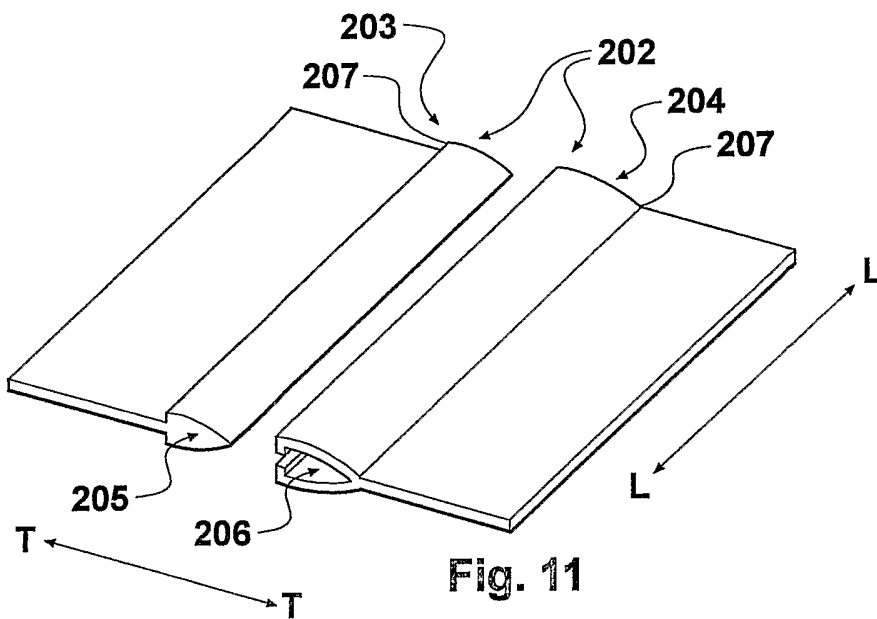


Fig. 11

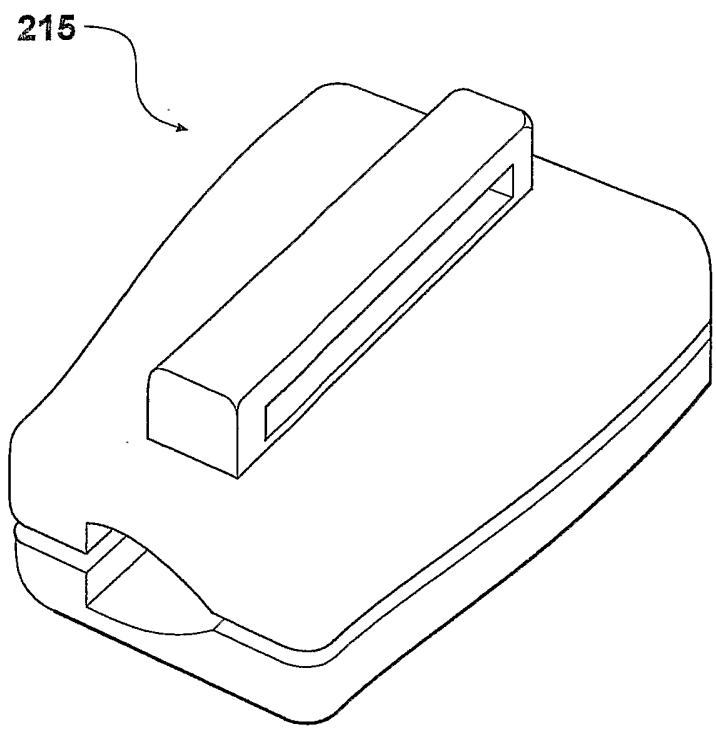


Fig. 12

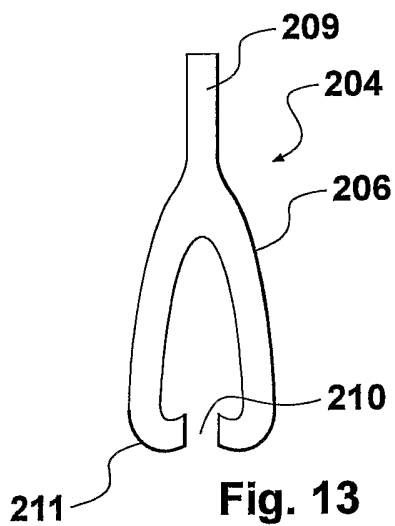


Fig. 13

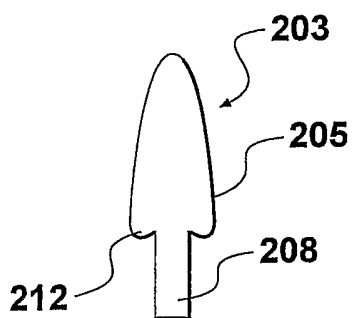


Fig. 14

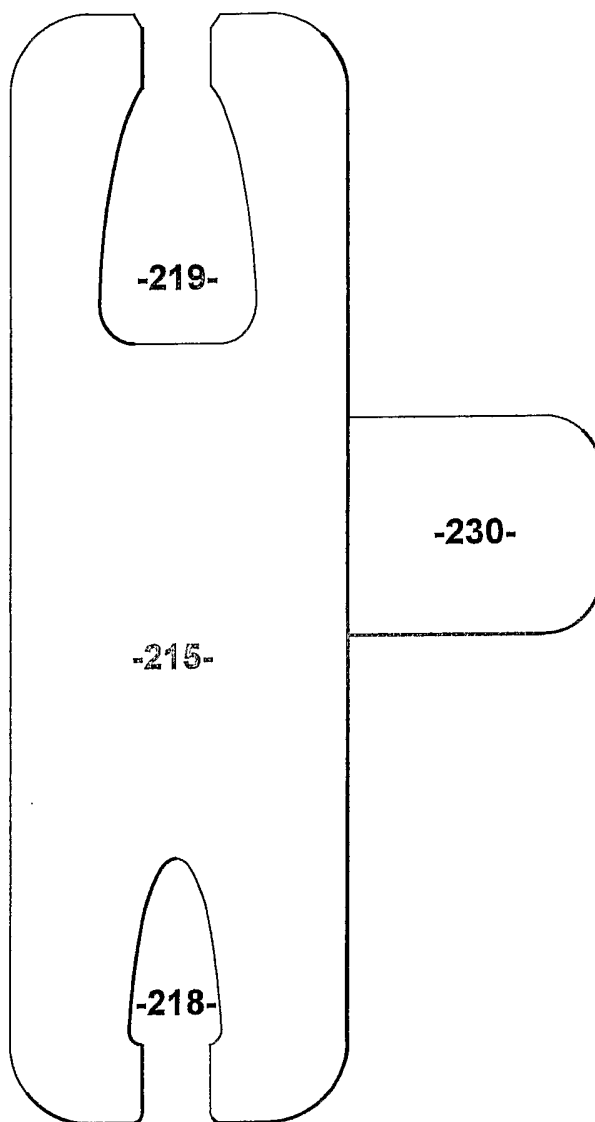


Fig. 15

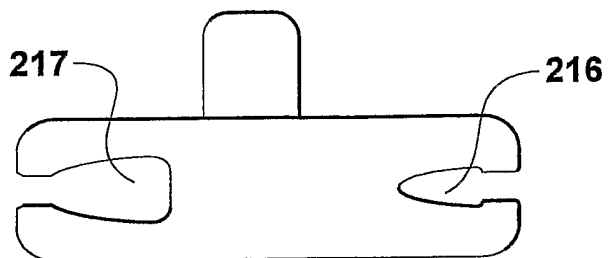


Fig. 16

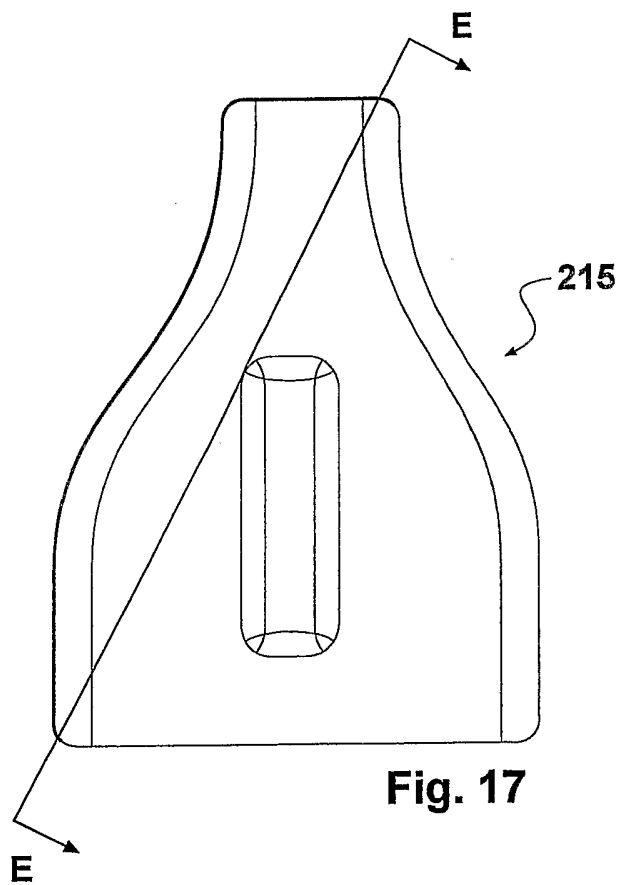


Fig. 17

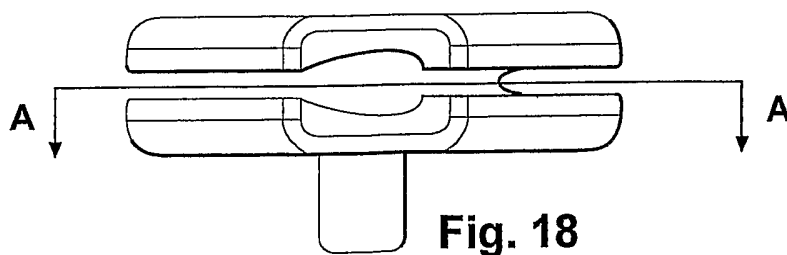
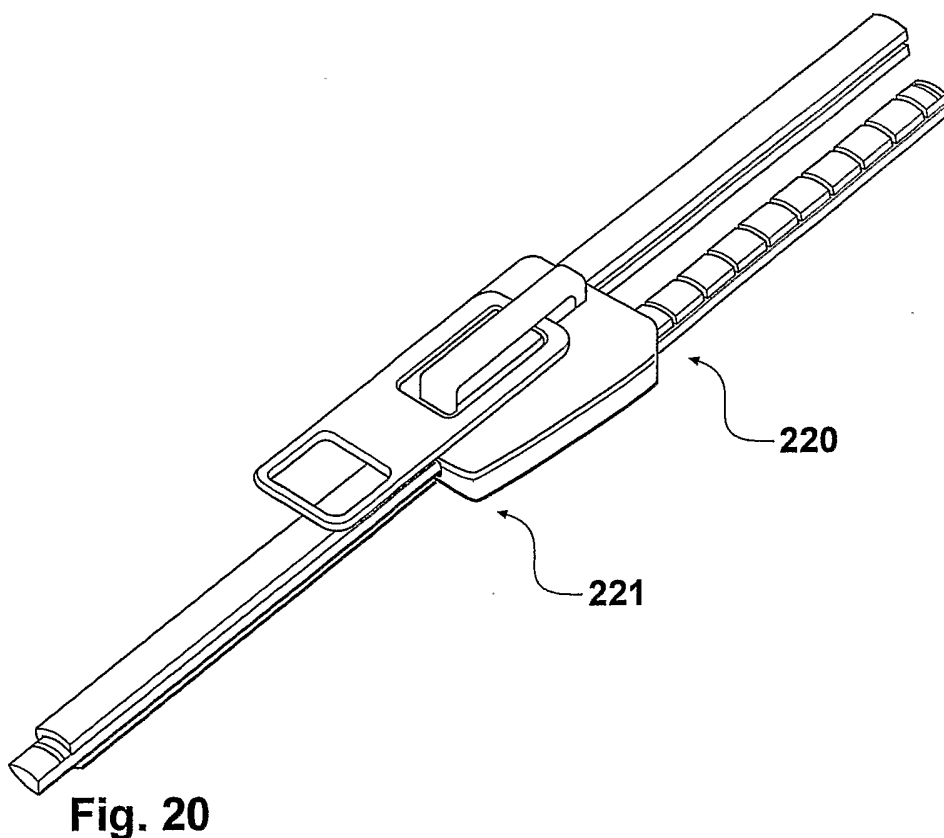
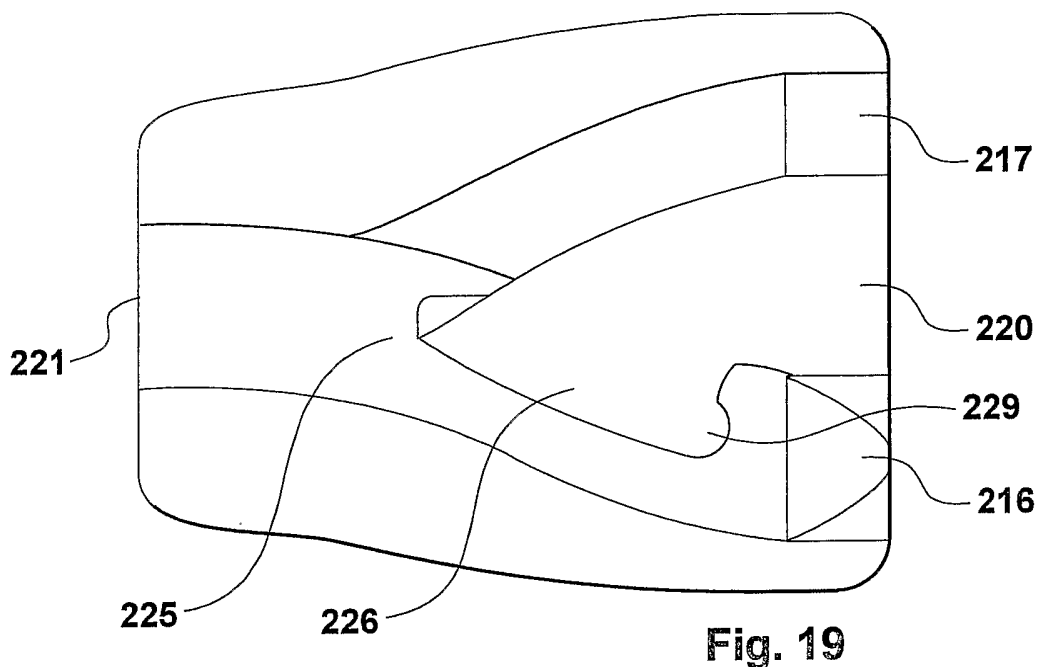


Fig. 18



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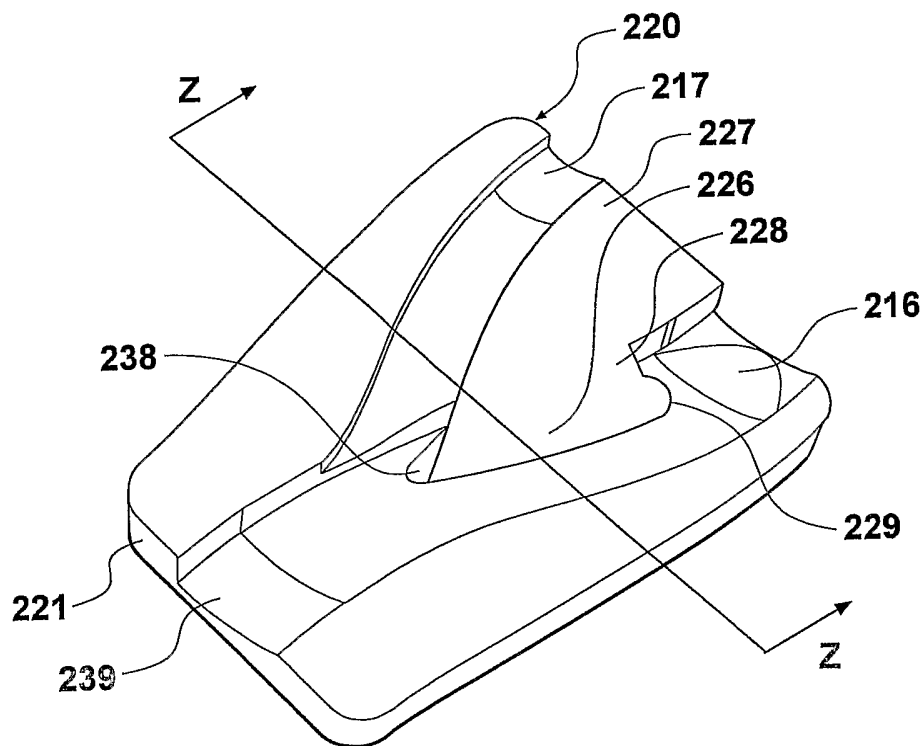


Fig. 21

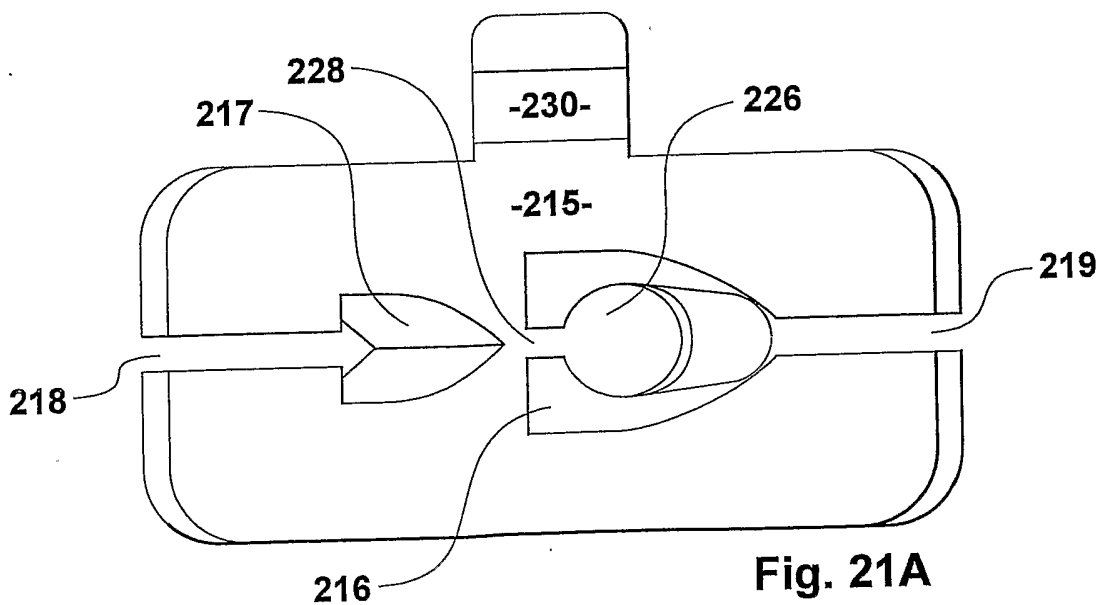


Fig. 21A

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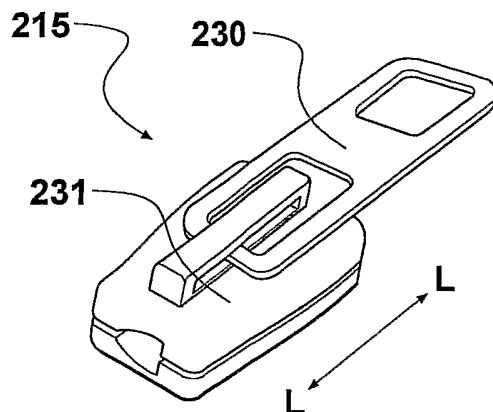


Fig. 22

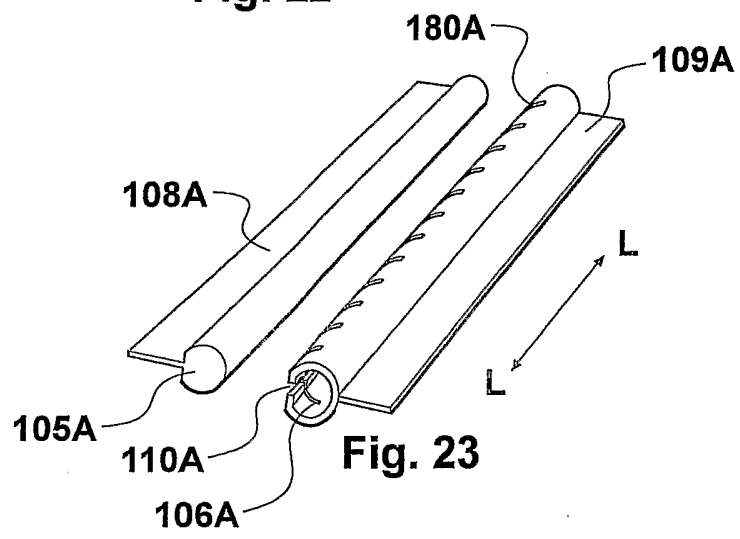


Fig. 23

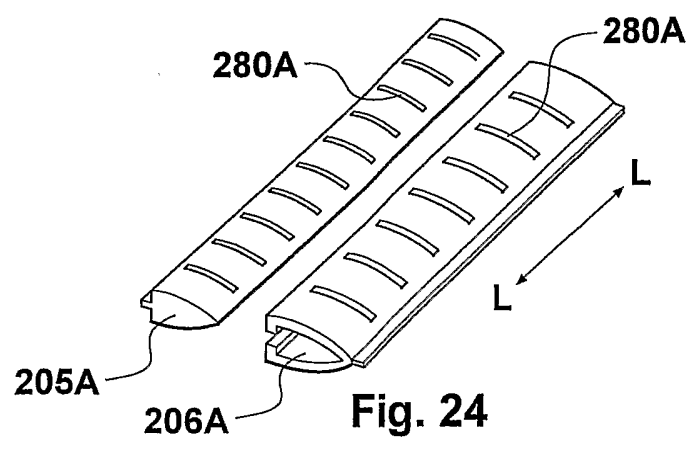


Fig. 24

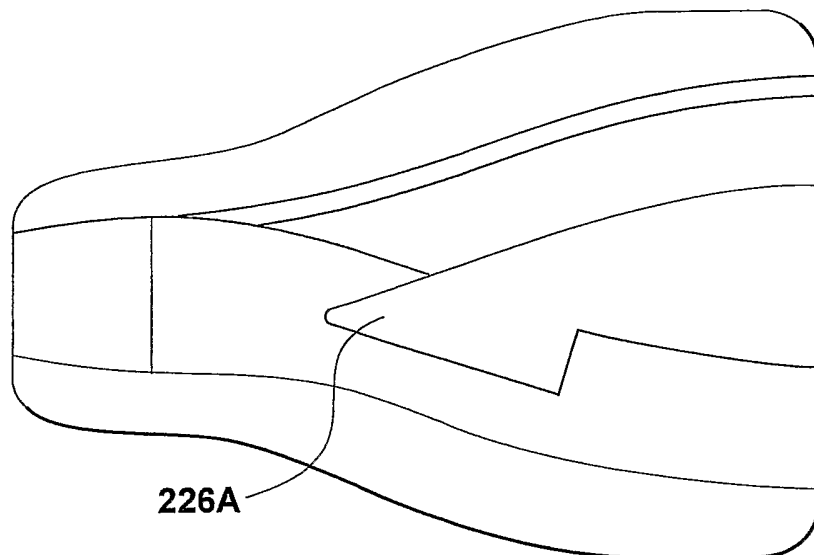


Fig. 25

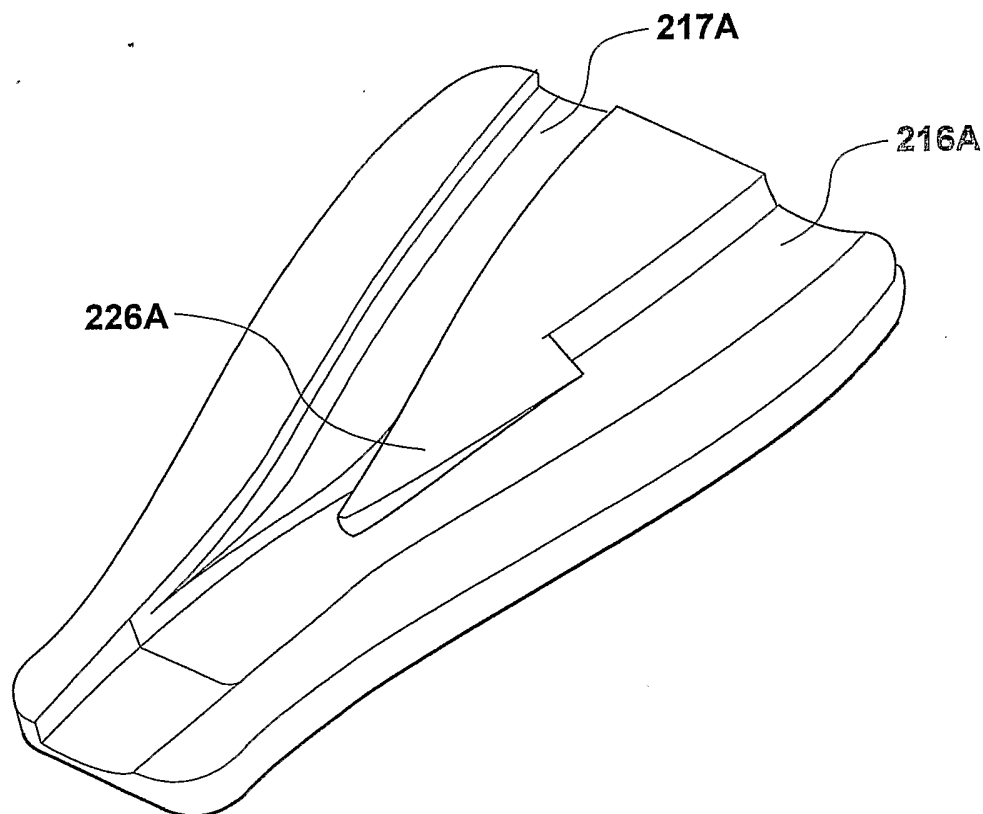


Fig. 26

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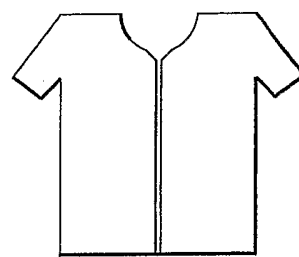
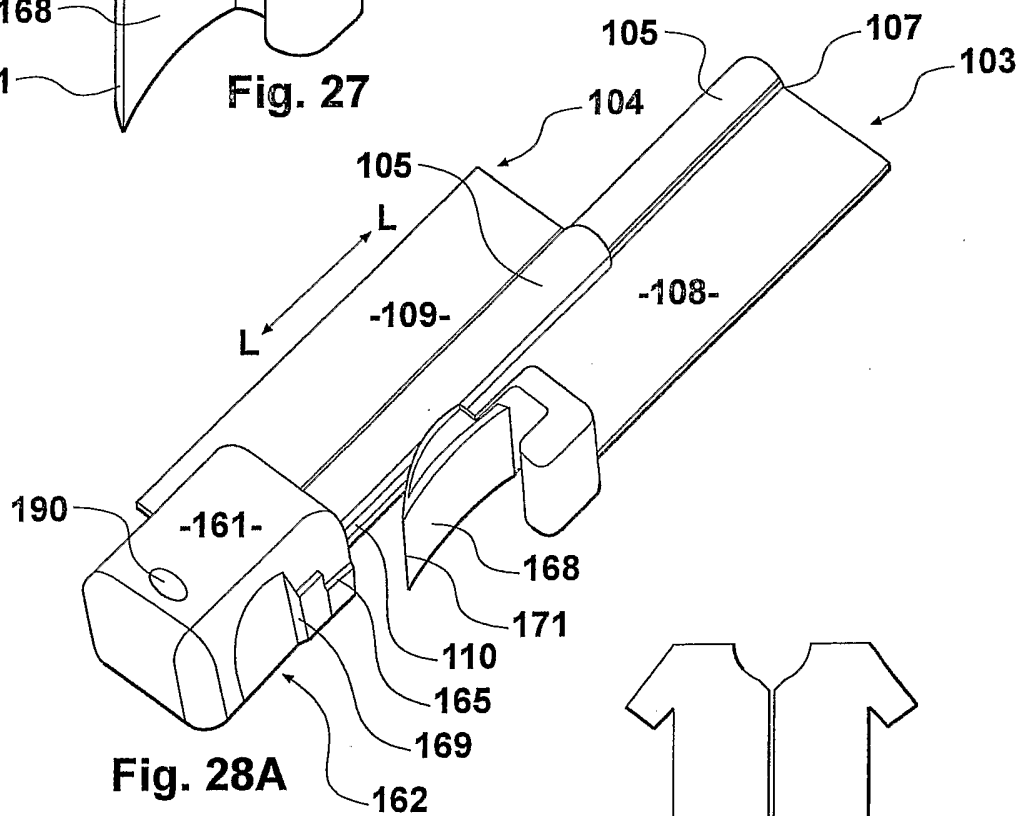
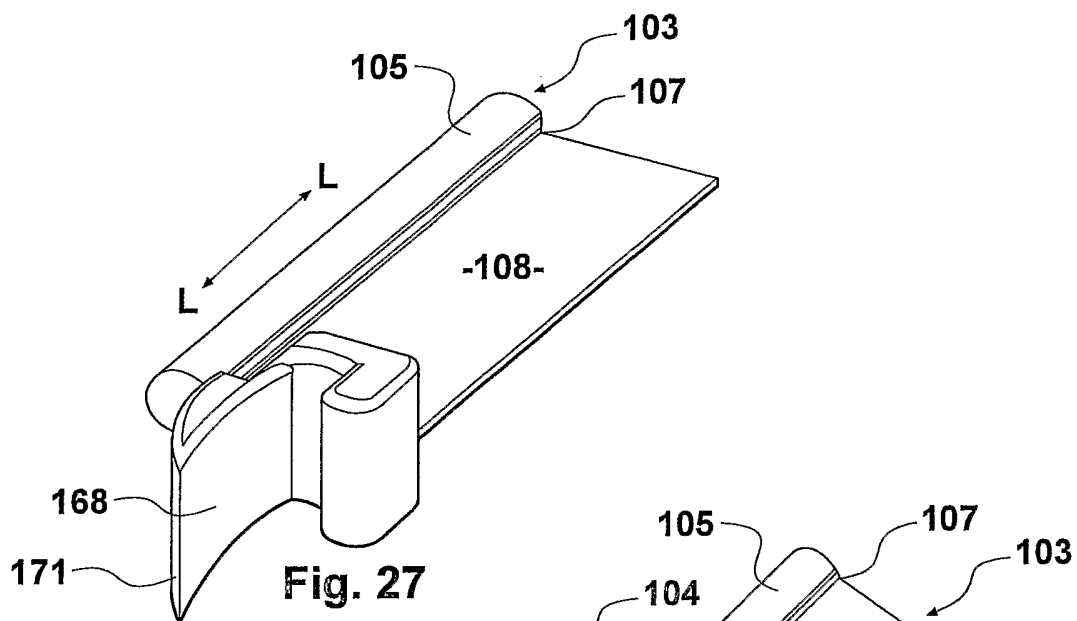
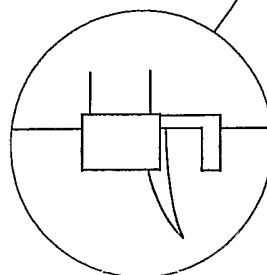


Fig. 28B



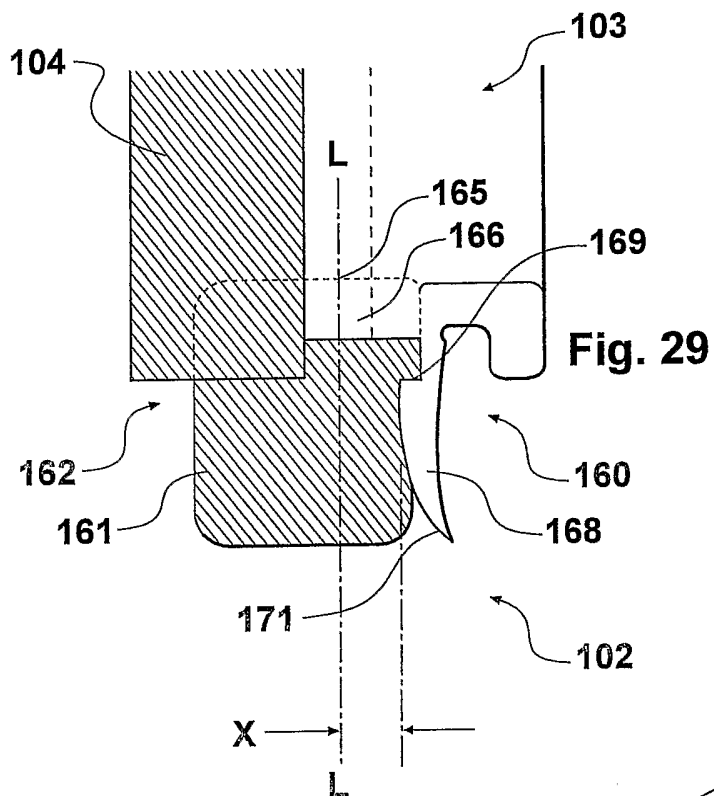


Fig. 29

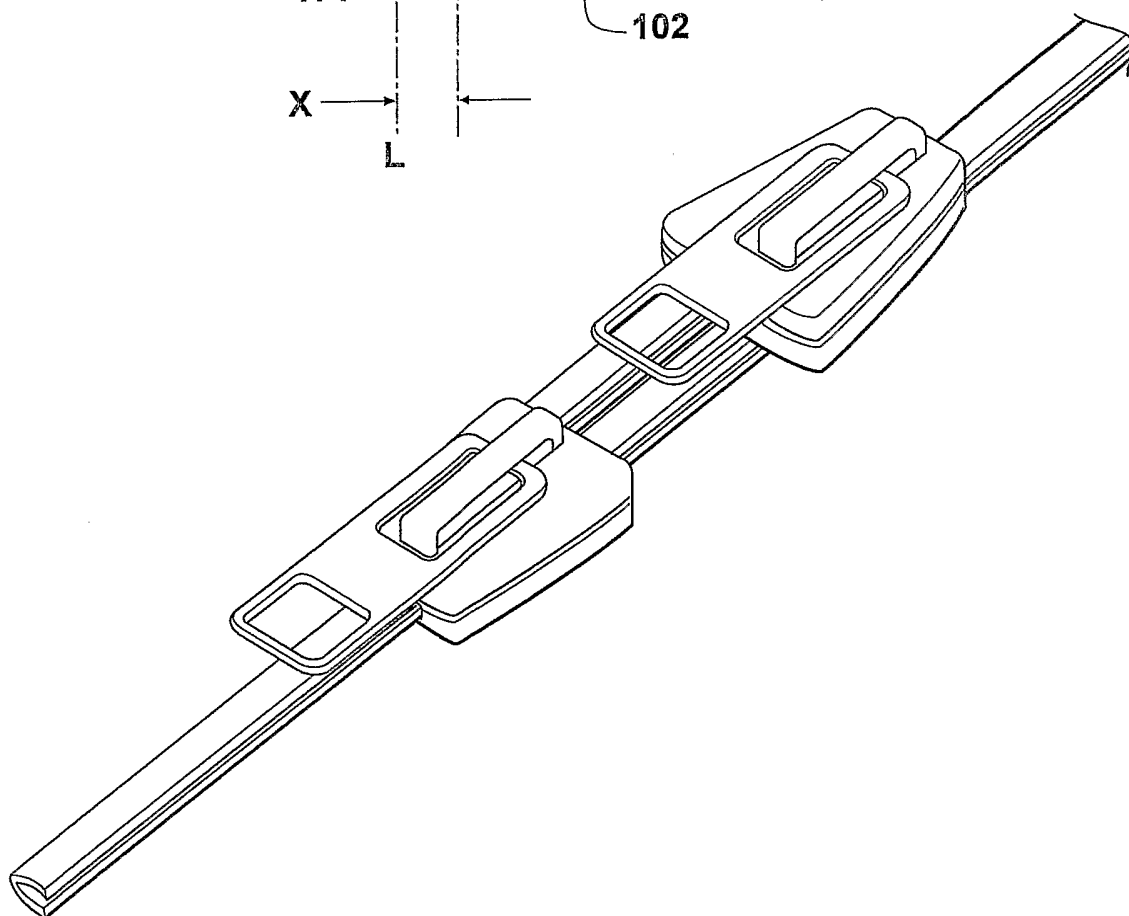


Fig. 30

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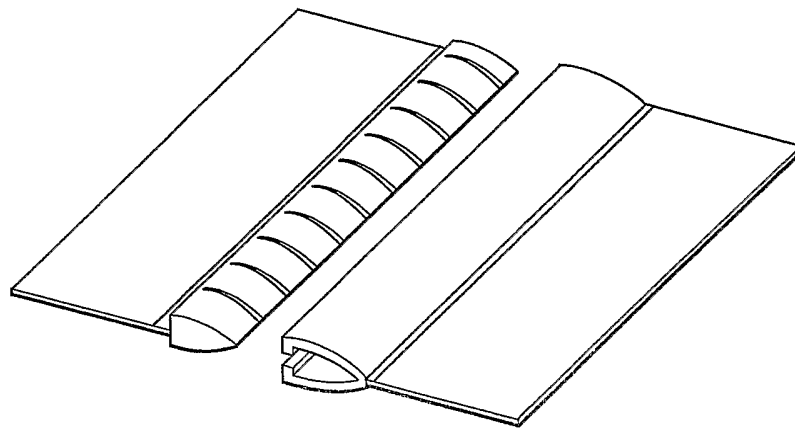


Fig. 31

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/NZ2005/000198**

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl. <sup>7</sup> : A44B 19/32, 19/16, 19/04, 19/26, 19/38		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
DWPI IPC - A44B 19/-, A44B 19/04, 19/10, 19/14, 19/16, 19/26, 19/28, 19/30, 19/32, 19/36, 19/38, 19/60, B65D 33/25, A41F 1/00, A43C 11/12, A45C 13/00, 13/10, B29D 5/08, 5/10, B21D 53/56 & keywords (male, female, slot, tongue, fluid, water, wet, rain, barrier, resist, water proof, stretch, lengthen, elongate, latch, pawl, end, stop, expand, splay, widen) & like terms		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X X,Y Y	DE 3240150 A1 (SCHUMANN) 3 May 1984 Whole document	1-2, 7 3, 5-6, 8-11, 4
X Y	GB 731834 A (MASTRACCHI-MANES) 15 June 1955 Whole document. See especially figures 1, 2, 4; page 2, line 77 to page 3 line 6	1-3, 5-11 4
X X,Y	DE 2341452 A1 (BUTENUTH) 27 February 1975 Especially figures 1-5	1-3, 5-11 4
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search 18 November 2005	Date of mailing of the international search report 28 NOV 2005	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer  <b>ALLAN SMAILES</b> Telephone No : (02) 6283 2154	

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ2005/000198

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 1997/007702 A1 (SEO) 6 March 1997 Especially figures 1-3	1-2, 7 3-6, 8-11

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

**PCT/NZ2005/000198**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member
DE 3240150	NONE
GB 731834	NONE
DE 2341452	NONE
WO 9707702	JP 2000210107

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX