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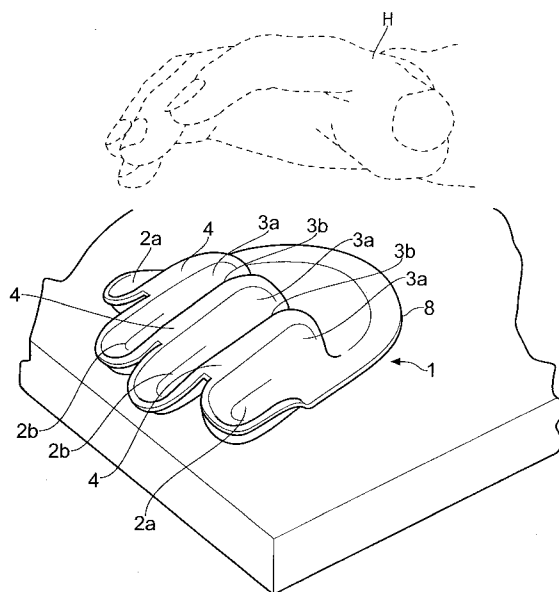
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(54) Title: A HAND UTILITY INTERFACE



(57) Abstract: A hand utility interface (1) as illustrated in figure (1) has a medially symmetric body providing two lateral finger channels (2a) and two medial finger channels (2b) extending from a palm part (8) whereby it can be used by either left or right hand. The interface (1) is fabricated from a thin self supporting resilient membrane so that when the fingers of a hand "H" are pressed down into the finger channels (2a, 2b) the interface gently grips the fingers thereby attaching itself to the hand for use. The interface is sufficiently flexible to reflect the flexure of the fingers of the hand "H". The structure of the interface is such that extension and spreading of the fingers effects single handed discarding of the interface.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A HAND UTILITY INTERFACE

TECHNICAL FIELD

The present invention relates to a hand utility
5 interface which can grip the hand of a user.

PRIOR ART

The closest known prior art is represented by the
applicant's published International application
10 identified here as WO 2006/000762 and WO 2004/098365.
Each of these disclosures concerns a hand utility
interface fabricated from a block foam structure.
While these hand utility interfaces have excellent
performance, the fabrication from a block of foam
15 presents certain technical limitations which the
present invention seeks to alleviate. In particular
the fabrication of a hand utility interface at minimal
cost, which is very light, and may provide a
waterproof and chemical barrier between the users hand
20 and the task; which can be made very flexible and
resilient, and in which the flexibility and resilience
can be adjusted to a range of applications; which can
take a range of attractive textures and appearances
and which delivers protection for the hand, fingers
25 and nails from knocks and stubbing of the finger tips.

STATEMENT OF INVENTION

Accordingly the present invention provides a hand utility interface comprising finger channels each channel sized and shaped to receive one finger of the users hand, wherein the users hand is releasably gripped by the hand utility interface when the fingers of the hand are pressed through an open top of the channel characterised in that;

the hand utility interface is fabricated from a self supporting resilient membrane.

According to a second aspect of the present invention there is provided a hand utility interface comprising open topped finger channels each finger channel having a structure which grips a finger of a user when the finger is pressed down into the channel through an open top to retain the interface on the users hand, and which is resiliently flexible to be retained even when the fingers of the hand are flexed.

According to a third aspect of the present invention there is provided a hand utility interface comprising open topped finger channels, each finger channel having a structure which grips a finger of a user when the finger is pressed down into the channel through an open top to retain the interface on the users hand, wherein the structure is resiliently

flexible to mimic the movements of a users fingers when the fingers are flexed.

According to a fourth aspect of the present invention there is provided a hand utility interface comprising open topped finger channels, each finger channel having a structure which grips a finger of a user when the finger is pressed down into the channel through an open top to retain the interface on the users hand, wherein the interface has a structure such as to enable it to be discarded single-handed by the fingers.

As will be appreciated from consideration of the following detailed description of embodiments of the hand utility interface, the invention may provide an interface with different utilities such as cleaning media, abrasive media, polishing media and many others to perform work while minimising the labour involved by obviating the need for the user to grip a cleaning, brushing or polishing apparatus and enabling an operator to address a greater surface area with each pass of the hand than could be otherwise addressed.

BRIEF DESCRIPTION OF THE DRAWINGS:

Embodiments of the hand utility interface constructed in accordance with the present invention will now be

described, by way of example only, with reference to the accompanying Figures, in which:

Figure 1 is a perspective view of a hand descending to engage a hand utility interface according to the invention;

Figure 2 is a perspective view of the relaxed hand engaged by the interface of Figure 1;

Figure 3 is a plan view of a small relaxed hand engaged by the interface of Figure 1;

Figure 4 is a plan view of a large hand gripped in the interface of Figure 1;

Figure 5 side section through a lateral finger channel of the interface of Figure 1;

Figure 6 shows a perspective view of the hand gripped in the interface of Figure 1 in the process of flexing the fingers;

Figure 7 shows a perspective view of a hand flexing the fingers at different angles whilst gripped by the interface of Figure 1;

Figure 8 shows a perspective view of a hand with the fingers extending and spreading to discard the interface of Figure 1;

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Figures 9A to 9C are diagrammatic sectional views on the line III-III in Figure 3 through two finger channels of an interface showing the gripping structure which is used in a first variant to grip the fingers of a hand;

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Figure 9D shows a detail enlargement of the structure in Figure 9D.

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Figures 9E and F are diagrammatic sectional views showing second and third variants of the gripping structure shown in Figures 9A to 9D;

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Figure 9G is a sectional view of fourth variant of the gripping structure, as it would be seen on the line III-III;

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Figure 9H is a side elevation of the fourth variant structure of Figure 9G in the direction of the arrow G;

Figure 9I is a diagrammatic sectional view of a fifth variant;

Figure 9J is a diagrammatic sectional view of a sixth variant;

Figure 9K is a diagrammatic perspective view of seventh variant of the gripping structure;

Figure 9L is a diagrammatic perspective view of a seventh variant of the gripping structure;

Figure 10A is a plan view illustrating optimised dimensions applicable to any embodiment of the interface;

Figure 10B is a sectional view on the line XIB-XIB illustrating optimised dimensions applicable to any embodiment of the interface;

Figure 10C is a sectional view on the line XIC-XIC illustrating optimised dimensions applicable to any embodiment of the interface;

Figure 11A is a side elevation of a first detailed embodiment of the interface;

Figure 11B is a plan view of the first detailed embodiment of the interface;

Figure 11C is a sectional view on the line XII-XII in Figure 12B;

Figure 11D is a side elevation of a first variant of the first detailed embodiment with the lateral finger channel cut away;

Figure 11E is a plan view of a second variant of the first detailed embodiment;

Figure 11F is a plan view of a third variant of the first embodiment;

Figure 12 is a plan view of a variant of the interface;

Figure 13A shows a side elevation of the second embodiment;

Figure 13B is a plan view of the second embodiment;

Figure 13C shows a section on the line XIII-XIII

Figure 14A is a side elevation of a first variant of the second detailed embodiment;

Figure 14B is a plan view of the variant shown in Figure 14A;

Figure 14C is a section on the line XIVC-XIVC in 14B;

Figure 14D is an enlarged section on XIVD-XIVD in Figure 14B

Figure 15A is a plan view of a second variant of the second detailed embodiment;

Figure 15B is a sectional view on the line XVB-XVB in Figure 15A;

Figure 15C is a sectional view on the line XVC-XVC;

Figure 16A shows a plan view of a third detailed embodiment of the invention;

Figure 16B shows a side elevation of the third embodiment of the invention;

Figure 16C shows a sectional view through the line
XVIC-XVIC;

5 Figure 16D shows a sectional views through the line
XVID-XVID;

Figure 17A a shows a side elevation of a fourth
detailed embodiment of the interface;

10 Figure 17B shows a plan view of the fourth detailed
embodiment of the interface;

Figure 17C shows a sectional view on the line XI-XI;

15 Figure 18A shows a sectional view of a fifth detailed
embodiment of the invention;

Figure 18B shows a sectional view of a variant of the
fifth detailed embodiment;

20 Figure 18C shows a plan view of a second variant of
the fifth detailed embodiment;

25 Figure 18D is a sectional view on the line XII-XII of
the fifth detailed embodiment detailing a valve to
control the discharge of flowable material;

Figure 18E is a detail of the value in Figure 12D;

Figure 18F is a section through a third variant of the
5 fifth detailed embodiment;

Figures 19A to 19C show partial perspective views of
variants of the wall and bridge structure.

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DETAILED DESCRIPTION OF THE DRAWINGS

Any feature described below as a variant may be
applied to any embodiment of the invention.

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Figures 1 to 8 according to preferred embodiments of
the invention illustrate the mode of use of the hand
utility interface. As can be seen from these Figures,
the hand utility interface 1 is fabricated from a
membrane, which although thin, forms a self supporting
20 interface structure. The interface has four open
topped finger channels and in the case of this
preferred embodiment four finger channels 2a, 2b. The
finger channels 2a, 2b are each sized and shaped to
receive one finger of the users hand "H". The finger
25 receiving channels act to releasably grip the hand
utility interface to the users hand when the fingers

of the hand "H" are pressed through the open top of each finger channel 2a, 2b with the fingers of the hand slightly extended and spread. The utility can then be picked up simply by relaxing the fingers and raising the hand as shown in Figure 2. It should be noted that the user does not need to grip the interface 2; the hand and fingers may remain completely relaxed while the hand utility interface 2 continues to gently grip the hand.

In order to grip the fingers of a hand the inner, medial finger channels 2b, have opposing side walls, 3a, 3b which deform elastically as a finger is pressed in through the open top of each of the channels 2a, 2b. The preferred structure for achieving this is illustrated diagrammatically in Figures 6A and 6B. The structure consists of a bridge part 4 which is supported at a height "h" above the middle height "m" of the finger F by the side walls 3a, 3b. The values of m and h are established from a careful analysis of the known sizes of adult female and male hands so that a single size of the interface can be configured to fit at the least the majority, preferably the great majority of adult female and male hands. The interface is useful, that is to say will cooperate with the hand sizes of:-

British men between the 5th %ile and the 97th %ile
US men between the 7th %ile and the 95th %ile
British women between the 6th %ile and the 98th %ile
US women between 8th %ile and the 98th %ile

Data drawn from People Size - Open Ergonomics Ltd.

5 It is a desirable feature of the interface that it is
not chiral, that is to say it is neither left-handed
nor right-handed but can be used ambidextrously by
either hand. To achieve this the two longer medial
finger channels 2b are made of equal length while the
10 short, lateral finger channels 2a are of similar
length to each other. The interface is symmetric
about a medial axis "M" extending between the two
central finger channels 2b.

15 The description above explains how the interface grips
a finger or more usually fingers on the hand in a
relaxed condition, this condition is illustrated in
Figure 2, Figure 3 and Figure 4. Figure 5 illustrates
how a base part 6b of each finger channel 2b is domed
to follow the relaxed curvature of a hand. As shown
20 in Figure 6 the interface 1 is sufficiently flexible
and resilient to allow it to be crushed in a fist and
to recover its shape many times during use.

The functionality of the interface is further enhanced by the arcuate base shape illustrated in the side elevations of Figures 11A, 11D, 13A, 14A and 15B because at least in part as a consequence of this shape the interface can easily be discarded simply by extending the fingers. This causes the fingers to spread so opening the channels and generating an impulse projecting the interface from the hand. The hands may press against the arcuate base part 6b shown in Figure 10B of the interface 1 so that the fingers are encouraged to disengage from the finger channels 2a, 2b. In the case of some hands in certain forms of the interface, it may prove of assistance to differentially extend the fingers to discard the interface 1 or to discard the interface using a throwing motion in combination with extending the fingers. Thus unlike a conventional glove it is possible to "put on" and readily remove the interface 1 single-handed.

For the utility of the interface to be maximised it is desirable that a single size of interface fit the largest possible range of hands. After considerable research the inventors have optimised the design of interface for an adult hand. The internal dimensions

of the finger channels 2a, 2b and their relative locations are illustrated in Figures 10A, 10B and 10C. These dimensions may advantageously be applied to every embodiment of the interface 1. However, some dimensions may usefully be altered for special applications. For example the angle between the symmetric axis of either one of the medial finger channels 2b and the medial axis "M" is shown as 1.5° , this may usefully be altered between as little as 1° to as great as 18° . It may be noted that the radius of curvature "R" of the proximal end of the walls is approximately an arc of a circle and has a radius of substantially 20mm to promote ease of moulding.

As shown in Figures 2 and 3 the sizes of finger channels selected allow the largest usually male hand to fit the fingers into each finger channel 2a, 2b so that at least the interphalangeal joints of each finger are engaged in the channels 2a, 2b. If the crotch between the fingers is outside the channels the grip of the interface on the fingers is largely unaltered. Conversely a small sized hand may have the whole of each finger within each corresponding channel, perhaps leaving a space at the fingertip, without significantly altering the grip achieved by the interface 1.

Alternative dimensions optimised for other ranges of hand size are contemplated particularly for the hands of children.

5 The interface can be crushed in a fist or similarly flexed in order to grip or work around a surface during use.

10 The bridge part 4 is rendered stiff relative to the sidewalls 3a and 3b. This can be achieved by a number of mechanisms but in the present case is readily achieved by making the bridge part thick relative to the sidewall parts. This can be readily achieved in a vacuum moulding process used to manufacture the
15 interface. As a finger F is pressed through the open top of each of the finger channels 2a, 2b the resiliently deformable bridge part 4 elastically deforms to allow entrance of the finger F and then substantially recovers its rest shape. Accordingly
20 the user feels a small degree of resistance as the fingers are pressed into the finger channels. In order to grip the finger the sidewall parts 2a, 2b deform elastically from the rest condition shown in the left hand finger channel of Figure 9A to the
25 strained condition shown in the right hand channel, thus the bridge part 4 overlies the finger F to gently

lock it in place. The views shown in each of the Figures 9A-9G are schematic sections through an interphalangeal joint of the finger locating or located in a finger channel.

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The separation of the opposing side walls and the resilience of the material structure are chosen so that the side walls will grip the interphalangeal joints, for a wide range of finger sizes, while permitting the interface to be easily discarded. The relatively stiff bridge part 4 assists in achieving this effect because it acts to constrain and resist the inward collapse of the upper edge of any part of the wall 3. So that this feature is more reliably achieved each finger channel is shaped to taper from a wide end proximal the location of the metacarpophalangeal joint of a hand engaged by the interface, to a distal end. By arranging to grip most significantly the phalangeal joints of each finger it becomes possible to develop an interface able to accommodate a very wide range of hand sizes. A further significant benefit is that such gaps as are left between the sidewalls and the sides of a finger improve ventilation and hence comfort. These features can be appreciated best from Figures 3 and 4. Figure 3 illustrates the fit of an interface to a small adult

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hand while Figure 4 exhibits the fit of a large adult hand in the same interface.

It has also been found to be of benefit to incline the opposing sidewalls so that the distance between the bottom edges of the sidewalls is less than that at the top. This feature can be seen in the left channel of Figure 9A. By inclining the sidewalls 3 the finger channels are better able to fit a wide range of finger sizes.

At the time of writing the preferred best performing bridge structure is that shown in Figures 9A to 9D. The notable feature of this bridge structure is that it presents a convex uppermost surface. Making the uppermost surface of the bridge part 4 convex tends to guide the fingers of the hand into the finger channels 2a and 2b. Figure 9B illustrates two fingers fully engaged one in each of the finger channels 2a Figure 9C illustrates the way in which joins 5 between the edges of the bridge structure and the uppermost edges of the sidewalls 3 are engineered to articulate or hinge resiliently. As a result the finger F gripped in the finger channel can articulate about at least the metacarpophalangeal joint without the interface losing its grip on the finger and with little

resistance from the interface. Figure 9D shows an enlarged detail of the joins 5 illustrating how they are engineered so that the relatively large section of the bridge 4 merges progressively with the each joined wall 3a and 3b.

Figure 9E shows a second variant of the bridge part 4 which is substantially flat. Figure 9F shows a variant in which the bridge part 4 is concave.

In the bridge structure variant of Figures 9G and 9H the bridge part 4 is supported by a member 3' which rises from a base part 6 of the interface. Wall parts 3a, 3b depend from opposite edges of the bridge part 4 and are urged into engagement with the upper part of the finger by the resilience of the bridge part 4.

Figure 9I shows a variant of the interface which has no distinct bridge part. A curved or arched part 4' is formed integrally from the media and may be treated to be stiffer than the wall parts 3a and 3b. The media 23 may be an abrasive, or cleaning material. The upper surface of the media may be provided with a comfort layer 23a.

Figure 9J discloses a variant in which the self supporting membrane is moulded to form self supporting side walls 3a, 3b which define "U" shaped finger channels 2. The structure lacks a distinct bridge but simply rolls over to form the walls of the adjacent channel. Resilience to grip a finger is provided by subsequently packing the space 20 between the walls with a resilient material such as a resilient foam.

Figure 9K illustrates an variant wherein the finger channels 2a, 2b are provided by opposing sides of individual upstanding rows of resiliently deformable hollow posts 28 integrally moulded from the membrane of the interface 1. Each hollow frusto-conical post 28 tapers from a base to a head part 29. Pressure applied by a finger "F" causes the engaged post wall to deform resiliently as shown. The head 29 is located to serve the function of the bridge part 4 and to resiliently deform and recover as a finger "F" is pressed down into the channel 2b.

Figure 9L presents a further variant of the invention wherein the wall parts 3a, 3b support a bridge part 4 but in order to maximise flexibility of the interface with the hand these parts are separated by numerous laterally extending channels 31.

While the arrangements of the bridge described above grip the interface to the hand in the relaxed condition, the hand can be further discouraged from slipping from the interface during use by the provision of a polished surface, particularly in the region of the fingertips and under the fingers as shown at 7 in Figure 11B. Producing a polished surface finish in the region of the fingertips results in stiction between the fingertips and the interface assisting in providing an effective grip. The polished surface finish 7 can easily be achieved during the production process by producing a correspondingly polished finish on the corresponding surface of the mould. It has been found that a finish corresponding to an Ra value of 0.1µ or less is effective. Polished regions may be implemented where desired on any embodiment of the invention.

A roughened finish can be effected in much the same way for a similar purpose but will often not be preferred because its comfort and appearance may be unattractive to a user.

Many of the benefits of the present invention over the applicant's previous developments of a hand utility interface arise directly from the fabrication of the

interface from a thin self-supporting membrane and from the selection of the materials for that membrane which results in a hand utility interface which is light resilient and flexible and has properties capable of adopting a range of attractive textures and colours. Each embodiment of the invention is formed from a single sheet of a thin flat membrane. The membrane is no less than 0.5mm thick and not more than 5mm, preferably it is between 1.5 and 3.5 mm thick and the presently preferred thickness is 2.5mm, however the thickness of the stock membrane can readily be selected in order to adapt the hand utility interface to a range of applications. Preferably the hand utility interface is moulded by an inexpensive moulding process such as vacuum forming and press moulding although other forms of moulding such as injection moulding are possible manufacturing processes. A particularly suitable material or range of materials for this manufacturing process is described in detail in the various examples below.

Example 1.

The self supporting membrane is a material shaped by means of a vacuum forming process, a common method of plastics moulding. The membrane material comprises: physically cross linked, closed cell soft polyolefin

foam, deriving from a process employed by Sekisui Chemical co. Ltd, Japan, as detailed below:- The product specifically used is commercially referred to as Alveolit TEE M 1502 and Alveolit TLG M 1503 and was manufactured in Europe by a subsidiary of Sekisui ALVEO AAG, although it may be supplied from any of Sekisui's worldwide foam operations and/or subsidiary companies.

The product's formula derives from the following process:

blending a composition comprising: (i) 10-100 parts by weight of a ethylene polymer selected from vinyl acetate copolymer (EVA), ethylene ethylacrylate (EEA), ethylene acrylic acid (EEA), ethylene butylacrylate (EBA), very low density polyethylene (VLLDPE), metallocene PE's and combination thereof. In the present invention, EVA is the preferred polymer of choice, with a vinyl acetate content of between 3 and 70% by wt - %, preferably 5-30 wt %, even more preferably 14% by wt. The above ethylene polymer should have a Melt Flow Index (MFI) of 0.1 to 15 g/10 min at 190°C and 2.16 kg (determined by BS EN ISO 1133:2000) with a chemical blowing agent (or foaming agent) such as azodicarbonamide, with no restrictions of alternative types such as hydrazine compounds,

carbazides, tetrazoles, nitroso compounds or carbonates. In the present invention, azodicarbonamide is used preferentially.

5 For a skilled person the MFI gives a measure of the flow characteristics of a polymer and a rough indication of the molecular weight and processing behaviour.

10 Additionally, as required, other substances are added to the blend to facilitate processing. These are namely, phenolic antioxidants, process internal lubricants such as ZnSt, and blowing agent activation materials such as ZnO. In certain cases appropriate
15 colour pigments are added to enable final product colouration;

forming a sheet like material preferably by an extrusion process (either single screw or twin screw types), wherein the blending of the composition with
20 the chemical blowing agent is performed prior to and/or simultaneously with the forming; In a preferred embodiment, this process step is made at a temperature less than the activation temperature of the CBA, namely between 130°C and 160°C, with 145°C being the
25 optimum. Cross linking the sheet like material obtained in step b to a cross linking degree of 20-60%

(preferably 40%) as measured according to ASTM 2765 using xylene as a solvent to dissolve non-cross linked components. By means of any common cross linking process i.e. chemical or physical cross linking - with
5 physical cross linking with a high energy electron beam ionising process being particularly preferred. The cross linking degree is an expression of the weight % of cross linked material that remains; and foaming the cross linked sheet like material at an
10 elevated temperature (230°C) in a continuous process, to obtain a foam having a density of 20 to 400 kgs/m³ preferably 67 kg/m³ (as measured by ISO 845), and a thickness of 0.5 - 10mm, preferably 2mm.

15 The foaming is preferably conducted in a vertical and/or horizontal oven system. The cell size is preferably from about 0.05 to around 2mm, preferably from around 0.1 to 0.6mm. The cell size is measured by scanning electron microscopy.

20 The foam in the present invention is a soft foam. The softness can e.g. be expressed by the low compression strength values of the foam determined by ISO 844. These are preferably in the range of 25 to 60 kpa
25 measured on a foam with a density of 70 kg/m³ at a deflection of 25%.

Foam Composition 1 - TEE M 1502

A commercial EVA ethylene co-polymer with a VA content of 14% and a MFI of 4.0 g/10 min, is blended and compounded and moulded with an appropriate quantity of azodicarbonamide - around 7.1 % by wt to achieve 67 kg/m³ - , ZnO, Znst, phenolic antioxidant and colourant in a single screw extruder at a compounding temperature of 145°C. The resultant sheet is cross linked to a 45% level using an electron beam irradiation system, and vertically foamed at 230°C to result in a soft foam of density 67kg/m³, and thickness 2mm, with a fine closed cell structure averaging 0.2mm, providing a compression strength of 30 kpa at 25% deflection.

Foam Composition 2 - TLG M 1503

70% by wt % - of a commercial EVA ethylene co-polymer with a VA content of 14% and a MFI of 4.0 g/10 min, is blended with 30% by wt % - of a linear low density polyethylene, with a co-monomer based on C4, C6 or C8 (preferentially C8) and a MFI of 4.5 g/10 min, and compounded and moulded with an appropriate quantity of azodicarbonamide - around 7.5% by wt to achieve 67 kgs/m³, ZnO, Znst, phenolic antioxidant and colourant

in a single screw extruder at a compounding temperature of around 155°C. The resultant sheet is cross linked to a gel fraction level of 45% using an electron beam irradiation system, and vertically
5 foamed at 230°C to result in a soft foam of density 67kg/m³, and thickness 3mm, with a fine closed cell structure averaging 0.2mm, providing a compression strength of 40 kpa at 25% deflection.

10 **Example 2**

Alternative suitable materials have been especially developed by Trocellen GmbH as detailed below:

Foam A:

15 foam with density of 100 kg/m³:
type: „Trocellen C 10003 D03“, commercially available by Trocellen GmbH, Germany;
main properties: closed cell polyethylene foam, chemically crosslinked, high flexibility, density 100
20 kg/m³, thickness 3 mm (before thermoforming);

Foam B:

foam with density of 140 kg/m³:
type: „Trocellen C 14003 D03“, commercially available
25 by Trocellen GmbH, Germany;

main properties: closed cell polyethylene foam, chemically crosslinked, high flexibility, density 140 kg/m³, thickness 3 mm (before thermoforming);

- 5 These materials present advantageous characteristic properties as indicated below:

PROPERTY		TEST METHODS	UNIT	C 10003 DO3	C 14003 DO3
Thickness		ISO 1923	mm	3.10	2.9
Density		ISO 845	kg/m ³	111.5	141.2
Compression stress strength	10%	ISO 3386/1	kPa	33	56.15
	25%		kPa	62.33	93.94
	50%		kPa	158.67	219.29
Tensile strength	Longitudinal	ISO 1798	MPa	1.57	1.61
	Transversal		MPa	1.25	1.54
Elongation at break	Longitudinal	ISO 1798	%	323.5	363.2
	Transversal		%	432	445.2
Tear strength	Longitudinal	DIN 53 507	N/mm	3.89	3.97
	Transversal	DIN 53 507	N/mm	3.34	3.78
Compression set	25%,30', 23°C	ISO 1856	%	6.04	8.01
	25%,22h, 23°C		%	0.45	1.64
Compression set	50%,30', 23°C	ISO 1856	%	31.43	29.77
	50%,22h, 23°C		%	10.21	7.36
Fire behaviour	Flame speed	DIN 75200	mm/min	160	89
Shore	Shore 0	ASTM D 2240	Shore	31	32
	Shore 00	ASTM D 2240	Shore	64	67
	Shore A	ISO R.868	Shore	25	28
	Shore D	ISO R.868	Shore	2	3
Conditioning	Conditioning time		Hours	>72	>72
	Temperature		°C	21	21
	Humidity		%	40	42

A further possible material of use is Ethylene Propylene Dimonomer (EPDM) a terpolymer elastomer. This produces a particularly soft feeling flexible interface.

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By manufacturing the interface from the materials described many of the required properties of resilience and flexibility, and durability texture and appearance can readily be imparted to the interface.

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Further changes in appearance texture and utility can be achieved by the application of other surface materials prior to or during the blow moulding stage. For example, flocking can be deposited on the surface of the membrane prior to blow moulding, which then forms a textured lining to the hand engaging surface of the interface.

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FIRST DETAILED EMBODIMENT

The detailed first embodiment of the hand utility interface shown in Figures 11A-11C consists of a formation of four finger channels 2a, 2b diverging from a palm supporting part 8 as can be seen in Figure 11A the palm supporting part 8 continues to follow the curvature of the base parts 6b. The palm supporting part 8 is also curved in a plane perpendicular to the palm and the symmetric axis of the interface to form a

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dome the extent of which is indicated at 8' in Figure 11A which complements the natural relaxed condition of the palm of the hand.

5 Each of the long medial finger channels 2b is axis-symmetric, and the axis of each finger channel diverges from the median axis of the interface at an angle of about 1.5° when at rest. A proximal end of each medial finger channel 2b adjacent the palm part
10 is substantially 18 mm in width at the top of the channel. Upstanding sidewalls 3a, 3b diverge from the edges of the base of the finger channel 2b with an angle of substantially 10° between them. The opposing sidewalls 3a, 3b converge from the proximal end of the
15 finger channel 2b past the position 9 (indicated between the dashed lines) corresponding to the proximal interphalangeal finger joint until they reach a position corresponding to the position 10 (between the dashed lines) of a distal interphalangeal joint of
20 a finger received into the finger channel 2b. At a distal interphalangeal joint position 10 the width of the channel 2a is substantially 16 mm. This taper of the sidewalls encourages engagement thereof with the interphalangeal joints of a finger. In a tapering
25 region of the finger channel the resilience of the sidewalls and bridge part 4 are able to accommodate a

wide range of finger sizes, however at the tip of the finger channel the end wall 11a, 11b which protects the fingertips of a user greatly restricts the displaceability of the adjacent sidewalls. To

5 accommodate this, particularly when used by users with large hands, the tip end of the finger channel is widened at 46, as shown in Figure 10A and Figure 11B in this case to a width of some 17 mm distal of the position 10 of the distal interphalangeal joint.

10 Furthermore the sidewalls in this region are made more vertical relative to the proximal sidewall and in relation to the base plane.

Referring now to the lateral finger channels 2a, in
15 Figures 11A-11C in the embodiment shown these short lateral finger channels are asymmetric, each having a long medial side wall 3c, opposing a short lateral side wall 3d which extends back from the finger channel tip wall 11a to the distal interphalangeal
20 joint position 10. However it should be noted that the lateral side wall 3d of 11A may be extended further back to the position 9 of the proximal interphalangeal joint or even the position of the metacarpophalangeal joint.

As can best be seen from Figure 11C, the base parts 6b of each of the long medial finger channels 2b are each raised above the base parts 6c of the short lateral finger channels 2a. This further enhances the grip of the sidewalls on the fingers, when the fingers press against the base parts 6b during use the base parts 6b will be depressed and urge the sidewalls of the medial channels inwardly. This arrangement also provides for a chamber 6a beneath the interface to accommodate other auxiliary apparatus as shall be described later.

As can be seen in Fig 11B the distinguishing feature of this first embodiment of the invention is the provision of a gap 12a, b, c extending between the tips 11a, 11b of the walls of each of the finger channels 2a, 2b back to the distal interphalangeal joint 10. This enhances the sensitivity and flexibility and improves access to confined spaces and crevices for this embodiment. Enhanced protection for a users fingertips may be provided by a lip 47 which extends around the uppermost edge of the channel walls 2 and channel tip walls 11.

An advantage of fabricating the interface of the invention from a membrane is the facility to introduce various other structural features to enhance the

flexibility and stiffness of the structure in a controlled manner, and in particular locations so that flexibility and stiffness can be encouraged in particular directions as required. This first
5 embodiment of the invention exhibits certain of the features as described below. However it must be understood that these features may be implemented alone or together in any embodiment of the invention in order to optimise the interface for any particular
10 application.

Referring to the plan view of the first embodiment of the invention and Fig 11B, particularly to the right-hand side of the medial axis, the bridge part 4 and
15 sidewalls of the finger channels 2a, 2b are simple and unmodified. The sidewalls between the medial and lateral finger channels to the left of the medial axis exhibit a "V" section structure 13 which can be seen in hidden detail. A similar "V" structure 13' is
20 provided in the region of the proximal interphalangeal joint 9. This "V" structure 13 serves to increase the flexibility, in the direction of flexure of the fingers, of the medial wall of the lateral finger channel 2a, and of the lateral wall of the medial
25 finger channel 2b. Particularly in the case of very thin-walled interfaces, it will also help to keep the

wall self-supporting. In all cases these "V" shaped grooves in opposing medial and lateral walls project into the cavity beneath the bridge 4 in opposition to each other and may be arranged to touch. This functions to strengthen the wall and increase the wall resilience against the inward pressure applied by the finger joints. It should be noted that the location of these features along the finger channel is chosen with care to avoid coincidence with the position 9 or 10 of either interphalangeal joint.

Figure 11D shows a side elevation of the first embodiment with the lateral finger channel 2a cut away and part of the side wall 3b sectioned out. A wall 3c is formed to depend from the end of the bridge part 4 and between the side walls 3a and 3b of the adjacent finger channels 2a and 2b. The wall may be pierced by an aperture 3d which communicates through the wall 3d to a chamber 20a formed in the space 20 between the bridge part 4, the side walls 3a, 3b and the media. The aperture may be adapted to receive the nozzle of a charge bottle (not shown) able to discharge a flowable material to charge the chamber 20a. This material may then leak through a media 23 or be discharged through the aperture by squeezing the side walls.

Figure 11E illustrates a second variant of the first embodiment in which a media 23 is secured to the bottom of the interface 1. Notably the leading edge 23' of the media 23 extends in an arc forward of the finger channel tips 11a, 11b. The region shown with broken shading indicates the extent of the domed portion 8' of the interface 1 which is raised above a plane of the interface 1. The remaining area of the underside of the palm part 8 and finger channel tip regions 46a, 46b, are flat at rest and lie in a common plane. These flat regions provide a good surface for securing the media 23 to the interface. The process of securing may be via; adhesives, welding, mechanical fastenings, hook and eye fabric fastenings or any other suitable means.

In the third variant of the first embodiment shown in Figure 11F the media 23' is rectangular in plan and extends back under the palm part 8a. The palm part 8a is also of rectangular plan form.

Figure 12 illustrates a variant which may be applied to any detailed embodiment of this invention. In this embodiment it will be seen that the upper edge of the side walls 3a, 3b of each of the medial finger channels 2b are retained by the edge of a bridge

structure part 4'. This bridge structure part 4' has edges contoured particularly at 5' to closely follow the contours of a corresponding finger (not shown) thus the side walls 3a, 3b press snugly against the length of the finger and not just the interphalangeal joints.

SECOND DETAILED EMBODIMENT

Figures 13A, 13B and 13C show a second embodiment of the invention distinguished from the first embodiment mainly in that instead of a gap 12 a web 14 extends between and around the tips 11 of the finger channels. This may act to improve the protection afforded a user by the interface 1. In the structure shown to the left of the medial line, a "V" shaped groove 13 similar to those provided in the first embodiment is present. However an alternative structure is shown to the right of the medial line in Figure 13B. The opposing lateral and medial sidewalls of the medial and lateral finger channels are discontinuous at 15 and 15' these discontinuities positioned to avoid correspondence with the positions of the respective distal and proximal interphalangeal joints. The respective opposing sidewalls are joined by bridging walls 16 and 16' which bound the discontinuities. It will be appreciated that the discontinuities increase

the flexibility of the walls in the direction of flexure of the fingers. As with the "V" sections they increase the rigidity of the walls against lateral collapse promoting the possibility of constructing the interface from very thin membrane, perhaps as thin as 1.5 mm.

In other un-illustrated variants of the interface, as few as one discontinuity may be present between finger channels and in others three or more may be provided.

Figures 14A, 14B and 14C disclose a further variant of the second embodiment. In order to avoid repetition only those new aspects of the interface shown in Figures 13A, 13B & 13C will be described. In this embodiment the flexibility of the interface has been enhanced by the provision of sub-base inverted "V" shaped section 17 extending laterally under the base parts of each of the finger channels in the region of the positions of both finger joints. As can be seen in Figure 13C the "V" shaped sections 17 are moulded into the base in a manner which causes them to project up into each of the finger channels. This also acts to deter the interface slipping against fingers engaged in the finger channels 2a and 2b and assist in flexure. In this variation of the second embodiment

'V' sections 18 extend vertically in the sidewalls adjacent the sub-base grooves 17. These grooves 18 taper up to a point from their position adjacent the base.

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A further feature illustrated in Figure 14A and 14D is a step 33 formed into the base of the fingertips of the medial channels 2b at the point where the domed under hand element meets the base line under the finger tips of the channels 2b. This acts to improve fingertip grip on the interface and further prevent it sliding forward of the hand.

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Figures 15A, 15B and 15C illustrate a second variant of the second embodiment. In this second variant the protection afforded to a user by the interface one is enhanced by the development of a depending wall 32 which descends from the edge of the web 14 so following the outline of the web to the base plane. This depending wall might have apertures at the front end between the finger-tips.

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The sectional view Figure 15C illustrates a variant in which the sidewalls 3a and 3b are made relatively parallel in the direction vertical with reference to the base plane in which the media 32 lies.

THIRD DETAILED EMBODIMENT

Figures 16A, 16B, 16C & 16D show a third embodiment of the invention distinguished from the previous
5 embodiment in that the web 14' extends forward of the channel tip walls 11a, 11b instead of following the contour of the channel tips to support a wall 18 which extends symmetrically back from a point 19 towards the tips 11a of the lateral finger channels 2a. This
10 embodiment of the invention is envisioned to be useful in cleaning applications where it is desirable to drive a cleaning medium into corners and where additional protection of the finger-tips is desirable.

15 This third embodiment of the invention also exhibits the feature of a flange 18a extending around the leading edge and around the periphery to merge with the palm part. This flange provides an improved attachment and support structure for a cleaning or
20 other media 23.

Attachment of a cleaning or other media may be further improved by making the base parts 6b and 6c lie in the same plane as can be seen in Figure 16D. The media 23
25 can then be fastened to the underside of the base parts.

FOURTH DETAILED EMBODIMENT

Figures 17A, 17B and 17C illustrate a fourth embodiment of the hand utility interface this differs from the previous embodiments in that the palm part 8 and finger channels 2a, 2b are initially formed from a self-supporting membrane, however the resilience required to urge the sidewalls of the finger channels into engagement with the fingers is provided by packing the spaces 20 intervening between opposing sidewalls 3a, 3b of adjacent finger channels with a resilient medium.

This fourth embodiment may provide the resilient medium by means of a sack 21 containing a cleaning material, preferably in the form of a gel. The gel sack 21 may extend into the spaces 20 and may be welded in place. Preferably the gel sack 21 is transparent to allow inspection of the volume of material remaining inside. A press button 22 may be actuated to discharge a volume of gel into a cleaning medium 23 attached to the underside of the hand utility interface. So that the gel sack does not collapse as its content is discharged, each press of the button 22 causes a corresponding volume of air to be pumped into the gel sack.

FIFTH DETAILED EMBODIMENT

Figure 18A illustrates a fifth embodiment of the hand utility interface showing a first variant in which the spaces between the sidewalls 3 are each packed with a resilient material. In this particular example the packing material is a gel 34 contained within a flexible pack which may be welded in place. Alternatively a membrane may be welded to the base of the interface so that together they form a sealed cavity. When squeezed together the flowable gel material may be discharged into the cleaning media. The gel may provide resilience to the finger channel walls 2a, 2b. In an alternative example a set foam may substitute for the gel to increase the resilience of the sidewalls. In Figure 18A the cleaning media 23, such as a sponge, scourer, buff or cloth is permanently bonded to a flange 24 extending around the periphery of the interface 1.

Figure 18B is a second variant of the fifth embodiment in which a cleaning or abrasive media 23 is separably attached to the flange 24 by means of a fabric hook and eye fastening 25.

In a fourth variant of this embodiment (not illustrated) hook fabric fasteners are disposed on the sides of the interface. The media to be attached via these fasteners are wet and other wipes in a special package whereby the interface is pressed down into the package which then engages the topmost one of the media at the edges and which therefore comes away with the interface as it is lifted up.

Figures 18C to 18F show a further variant of the fifth embodiment. In this variant the spaces 20 beneath the self-supporting membrane contain a gel sack 21. The interface resembles the interface in the first or second embodiments in that a space 35 is provided beneath the palm part and the finger channels 2a, 2b into which the gel sack 21 extends. The gel sack 21 is tailored so that projecting portions 38 project up into the spaces 20 leaving a gap 39 between the walls 3a, 3b. Discharge of the gel sack 21 is controlled by a valve assembly consisting of an elongate resilient beam 26 with a medial portion secured by welds 37 to a relatively rigid member 27. The relatively rigid member 27 is bonded into a sealing membrane 27a which in turn seals the underside of the gel pack 21. The resilient beam 26 supports depending conical plugs 36 which extend down to engage in corresponding conical apertures 36a. Upright levers 29 extend from the ends

of the beam 26 to engage within the spaces 20
enveloped by the lateral sidewalls. At rest the beam
26 is biased to urge the plugs 36 to close the
apertures 28 so that the gel in the gel sack 21 cannot
5 pass into the medium 23. In order for a charge of the
gel to be discharged into the medium 23, the lateral
sidewalls are squeezed inwardly by either thumb thus
opening the apertures 28 by lifting the pegs 36 from
the apertures 36a and simultaneously compressing the
10 gel sack 21 to encourage the passage of gel through
the apertures. To further enhance the ergonomics of
this variant the outermost sidewalls, 2a,2b which are
short in most embodiments, are extended to reach the
region of location of the carpophalangeal joints. The
15 valve assembly is mounted as shown to underlie the
region of the carpophalangeal joints. This allows the
interface to flex about the joint with minimal
interference from the valve assembly and
simultaneously permits the valve assembly to be
20 actuated by the thumb of a user pressing against the
outside of the wall part.

The cleaning media 23 shown in Figure 18D is
permanently bonded to the interface 1 making the gel
25 sack irreplaceable, however the variant shown in
Figure 18F shows a gel sack 21 and cleaning media 23

secured to the interface 1 by hook and eye fabric fastening means 25 whereby both the gel sack and media may be replaced.

5 As may be seen in Figures 11B and 15A a transparent inspection window 40 may be provided through the palm to further enhance the utility of this variant by allowing a user to estimate the quantity of gel charge remaining in the sack.

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Figures 19A to 19C show perspective views of variants of the wall and bridge structure which may be introduced to any of the embodiments in order to enhance their flexibility and general performance.

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Each view is of a portion of the bridge structure in the region where the side walls of adjacent finger channels 2a, 2b meet. To enhance flexibility the variant of Figure 19A exhibits a plurality of parallel adjacent "V" section relief channels 41 extending laterally across the bridge 4. In the second variant of Figure 19B the laterally extending relief channels 41a are of "U" section. In the third variant of Figure 19C the "V" section relief channels are separated at the top at least by flats 42. Further flexibility is provided by continuing the "V" section relief channels at 41b down the side walls 2a, 2b.

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Figure 19B illustrates the provision of holes 43 in the bridge 4 which reduce weight and increase flexibility.

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Figures 10A, 10B and 10C disclose a further feature of the interface in which resilient "U" section structures 44 extend laterally across the underlying base panels 6a, 6b of the finger channels 2a, 2b.

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These "U" section base features cooperate with adjoining adjacent "U" section features 45, 45' rising up the side walls 2a, 2b. These features collapse readily when the fingers of a gripped hand are flexed.

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The interface has been described above as a means to engage a hand with another media, utility or working device for a very large possible range of purposes, including at least: baby care, beauty care, patient care, grooming of either people or animals, domestic surface care, wet trade and food surface care, hospital surface care, janitorial care, automotive care, boat care, DIY abrasives, automotive repair abrasives. However, the interface 1 may serve a useful purpose independently of any other attachment or apparatus, for example it may be produced having a very high degree of stiction in its bottom surface and

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as such employed to assist a user in gripping for the purpose of removing a lid from a jar for example. It is capable of serving many of the protective functions performed by a conventional glove. It may be possible to incorporate cleaning, disinfecting or other compositions into the membrane. Abrasives may be incorporated into the membrane.

A further advantage of the interface is the facility with which it can be crushed beyond its elastic limit in order to compact it for disposal.

The embodiments of a hand utility interface described and illustrated all present four finger channels; however, embodiments provided with only three or two finger channels are within the scope of this application and can readily be contrived by the skilled person from the description above.

It should also be noted that the hand utility interface may be picked up or engaged by the back of the fingers making it particularly useful for cleaning for example the inside of a car windscreen.

CLAIMS

1. A hand utility interface comprising at least two
finger channels each channel sized and shaped to
5 receive one finger of the users hand, the finger
receiving channels acting to releasably grip the hand
utility interface to the users hand when the fingers
of the hand are pressed through an open top of the
channel characterised in that;

10 the hand utility interface is fabricated from a
self supporting resilient membrane.

2. An interface according to claim 1 wherein each
channel has opposing side parts elastically deformable
15 by the ingress of a finger to resiliently grip at
least a part of the finger.

3. An interface according to claim 2 wherein the
parts of the finger gripped are the interphalangeal
20 joints.

4. An interface according to claim 2 or 3 wherein
the side parts are wall parts.

5. An interface according to one of claims 4 having a bridge part extending between adjacent finger channels and supporting wall parts.

5 6. A hand utility interface according to claim 4 wherein the bridge part is disposed at a height above the middle of a horizontal finger when the finger is pressed fully into the channel.

10 7. An interface according to one of claims 4 to 6 wherein the bridge part is supported by the side wall parts of adjacent channels, which descend, one each from each opposing edge of the bridge part to join adjacent finger channel base parts.

15 8. A hand utility interface according to claim 7 wherein the bridge part is stiff relative to the wall part.

20 9. An interface according to claim 8 wherein the bridge part is rendered relatively stiff by making the bridge part thicker than the wall part.

25 10. An interface according to any one of claims 4 to 9 wherein the wall part deforms elastically to grip the finger.

11. A hand utility interface according to claim 10 wherein the width of each finger channel is chosen so that the wall parts engage both of the interphalangeal joints of the finger to be received therein.

12. A hand utility interface according to claim 11 wherein a channel tapers from a proximal end to a distal end, corresponding to the proximal end of a finger and a distal end of a finger, in order to engage the distal interphalangeal joint.

13. An interface according to anyone of the preceding claims wherein the number, shape, size and configuration of the channels is arranged so that the interface is not chiral and can thus be used with either left or right hand.

14. An interface according to claim 13 wherein the number of channels is four, configured to be mirror symmetric about a medial axis, which in use sites between the ring finger and the middle finger.

15. An interface according to any one of claims 4 to 14 wherein the opposing sidewalls of each finger

channel converge from the open top towards the base part to improve the ability of the interface to grip a range of hand sizes.

- 5 16. A hand utility interface according to claim 15 wherein the dimensions of the channels are as follows:

Channel width (mm)		channel 2a	channel 2b
distal the metacarpophalangeal joint	at base		
	at top	-	16-20
distal the proximal interphalangeal joint	base		
	top	16 - 20	14-18
between the distal interphalangeal joint and tip	base		
	top	16-20	15-19

17. A hand utility interface according to claim 16 wherein the dimensions of the channels are as follows:

Channel width		channel 2a	channel 2b
distal the metacarpolphalangeal joint	at base		
	at top	-	18
distal the proximal interphalangeal joint	base		
	top	18.0	16
between the distal interphalangeal joint and tip	base		
	top	18	17- 18.2

5 18. An interface according to any one of the preceding claims wherein the length of the longest one of the channels is in the range 70 to 90 mm.

10 19. An interface according to claim 18 wherein the length of the longest one of the channels is 80 mm

20. An interface according to claim 14 wherein one of the channels is inclined to the medial axis at an angle of between 1° and 16°.

21. A hand utility interface according to any one of the preceding claims wherein regions of the upper surface of the base part are provided with a polished finish corresponding to an Ra value of 0.1 μ or less to enhance grip.

22. A hand utility interface according to claim 21 wherein the regions underlie the tips of the fingers during use.

23. An interface according to any one of the preceding claims wherein the hand utility interface is sufficiently resilient to substantially recover its shape having been crushed in a hand and released.

24. A hand utility interface according to any one of the preceding claims wherein the thickness of the membrane is in the range of 5mm to 0.5mm.

25. A hand utility interface according to claim 24 wherein the thickness is in the range 3.0-2.0mm.

26. An interface according to any one of claims 5 to 19 wherein each join between the bridge part and each one of the wall parts is an articulate joint, to accommodate movement between adjacent fingers.

27. An interface according to any one of the preceding claims wherein a region of the hand utility interface is rendered more flexible to follow flexing of the fingers by vertically extending "V" section or "U" section structures.

28. An interface according to claim 27 wherein the "V" section or "U" section structures extend vertically in a wall part.

29. An interface according to any one of the preceding claims wherein a discontinuity is formed to extend through the upstanding wall parts in order to increase the flexibility of the hand utility interface in the region of the discontinuity.

30. An interface according to any one of claims 7 to 29 wherein a region extending laterally through the base part is shaped to increase flexibility in the region.

31. An interface according to claim 30 wherein the weakening is provided by a "V" section or "U" section.

32. An interface according to anyone of claims 5 to 31 wherein the bridge part extends from the proximal end of a channel to a position corresponding to the distal interphalangeal joint, so that a gap extends from the distal end of the bridge part to the channel tip to increase the flexibility of the hand utility interface.

33. An interface according to any one of the preceding claims wherein the action of extending and spreading the fingers discards the interface.

34. An interface according to claim 33 wherein at least a base of a finger channel forms an arc rising and extending from the channel tip towards the palm part.

35. An interface according to claim 34 wherein a palm engaging part of the interface continues the arc of the finger channel base parts.

36. An interface according to claim 34 or 35 wherein the arc has a radius of curvature selected to conform to the curvature of a moderately relaxed hand.

37. An interface according to any one of claims 7 to 36 wherein outermost sidewalls of the interface descend to a plane beneath the base of the finger channels whereby pressing the central fingers in the direction of the base plane when the hand utility interface is engaged with a resistant surface for work encourages the side wall parts of the finger channels to increased engagement with a finger pressed into the channel.

38. An interface according to any one of the preceding claims fabricated entirely from a unitary sheet of membrane.

39. An interface according to any one of the preceding claims wherein the membrane is a thermoformable foam.

40. A hand utility interface according to claims 39 wherein the membrane is a polyolefin.

41. A hand utility interface according to any one of the preceding claims wherein the channel walls extend around the channel tip of each finger channel where the tip of a finger is to be accommodated, and wherein that portion of the finger channel lying distal of the

position where a distal interphalangeal joint of a finger will be received is of increased width, relative to the width of the adjoining proximal part of the channel, to alleviate pinching a finger tip during use.

42. A hand utility interface according to any one of claims 1-31 and 33-41 wherein a web of membrane extends between the tip of each channel from the uppermost edge of the walls

43. An interface according to claim 42 wherein the web extend distal of the channel tips and supports a descending outer wall.

44. A hand utility interface according to claim 42 wherein the descending outer wall converges to a point.

45. An interface according to any one of the preceding claims having a flocked surface finish.

46. An interface according to any one of the preceding claims having a coloured or patterned surface finish.

47. An interface according to any one of claims 3 to 16 wherein the adjacent wall parts and joining bridge part define the sides of a cavity beneath the hand utility interface.

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48. An interface according to claim 47 wherein the cavity is packed with a filler.

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49. An interface according to claim 48 wherein the filler is resilient.

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50. A hand utility interface according to any one of the preceding claims wherein the outermost sidewall joins on to a flange extending at least part way around the outermost periphery of the hand utility interface for engagement of the hand utility interface with a utility device.

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51. An interface according to claim 50 wherein engagement is achieved by one of either adhesive or fabric hook and eye fastening means.

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52. A hand utility interface according to any one of the preceding claims wherein at least the base part of each finger receiving channel remote from the tip joins to a palm supporting part.

53. An interface according to any one of the preceding claims adapted to provide one or more of the following functions: baby care; beauty care; patient care; grooming of people or animals; domestic surface care; wet trade and food service surface care; janitorial care; automotive care; boat care; DIY abrasive; auto repair abrasive; industrial abrasive.

54. A hand utility interface according to any one of the preceding claims in combination with a utility, wherein the utility is provided by a medium attached to the underside of the hand utility interface.

55. An interface according to any one of the preceding claims wherein the medium is one of a sponge, a scourer, a buff, a cloth or an abrasive

56. An interface according to claim 37 wherein the medium is replaceably attached to the hand utility interface.

57. An interface according to any one of the preceding claims wherein a charge of a paste, gel or liquid is stored in a cavity formed between the hand utility interface and the cleaning medium.

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58. An interface according to claim 57 wherein the charge is contained within a gel sack.

5 59. An interface according to claim 57 or 58 wherein discharge of the gel is controlled by means of a valve.

10 60. An interface according to claim 59 wherein a trigger to control valve is contained in the channel sidewalls.

15 61. An interface according to any one of claims 58 to 60 wherein a valve trigger and gel sack are integral components contained in the cavity.

20 62. An interface according to any one of claims 58 to 61 wherein the gel sack is transparent and a window is provided in the interface to enable a user to inspect the contents of the gel sack.

63. An interface according to claim 38 wherein the paste, gel or liquid is one of a cleaning material or polishing material.

25 64. An interface according to any one of the preceding claims rendered impermeable.

65. An interface according to any one of the preceding claims wherein a step is formed in the base of a finger channel proximal of the channel tip and distal of the position of the distal interphalangeal joint.

66. A method of manufacturing a hand utility interface comprising the steps of:

providing a "positive" die in the shape of a hand utility interface,

deploying a sheet of thermoformable membrane across the positive surface of the die,

heating the membrane and evacuating the space between the membrane and the die so that air pressure forces the membrane to take up the shape of the die,

encouraging the membrane to cool and removing the thermoformed membrane from the die, cutting around the membrane which has taken up the shape of the die to form an hand utility interface.

67. A method according to claim 66 wherein the surfaces of the die corresponding to the base parts of the hand utility interface are polished to a finish of less than Ra 0.1 microns.

68. A method according to claim 66 wherein the upper surface of the membrane is treated with a flocking material prior to vacuum forming to develop a flocked surface on the hand engaging surfaces of the hand utility interface.

69. A method according to any one of claims 66 to 68 wherein a plug tool is pressed on the membrane to take up the form of the die.

70. A method according to claim 69 wherein the plug produces embossing detail into the top surface of the interface.

71. A hand utility interface having:

a body defining at least two open topped finger channels whereby the insertion of fingers, one into each finger channel, causes the finger channels to hold the interface to the fingers,

said body comprising material and structures which impart sufficient resiliency and flexibility so that when the gripped fingers are differently flexed at least at the metacarpophalangeal joints of the fingers, the finger channel defining parts of the body

have sufficient independent mobility to reflect the flexing of the fingers while each finger remains gripped in its channel.

5 72. A hand utility interface having a body defining at least two open topped finger channels whereby insertion of the fingers one each into each finger channel causes the finger channels to hold the interface to the fingers, wherein a chamber is formed
10 in the body to contain and dispense a flowable material.

15 73. A hand utility interface comprising open topped finger channels each finger channel having a structure which grips a finger of a user when the finger is pressed down into the channel through an open top to retain the interface on the users hand, and which is resiliently flexible to be retained even when the fingers of the hand are flexed.

20 74. A hand utility interface comprising open topped finger channels, each finger channel having a structure which grips a finger of a user when the finger is pressed down into the channel through an
25 open top to retain the interface on the users hand, wherein the structure is resiliently flexible to mimic

the movements of a users fingers when the fingers are flexed.

75. A hand utility interface comprising at least two
5 finger channels each channel sized and shaped to
receive one finger of the users hand, the finger
receiving channels acting to releasably grip the hand
utility interface to the users hand when the fingers
of the hand are pressed through an open top of the
10 channel and maintain that grip despite manipulation of
the hand characterised in that;

the hand utility interface is fabricated from a
supple yet self supporting resilient membrane.

15 76. A hand utility interface comprising a flexible
resilient membrane having a portion for covering at
least part of the palm of a hand and at least two
finger channels each having an open top to permit a
respective finger of a hand to be inserted into, and
20 gripped by the sides of, the channel to hold the
member to the hand, the interface being constructed so
that at least partial flexing of the fingers received
in the channels independently of each other may take
place so as to cause corresponding flexing of the
25 membrane whilst said fingers remain gripped by the
sides of the channels.

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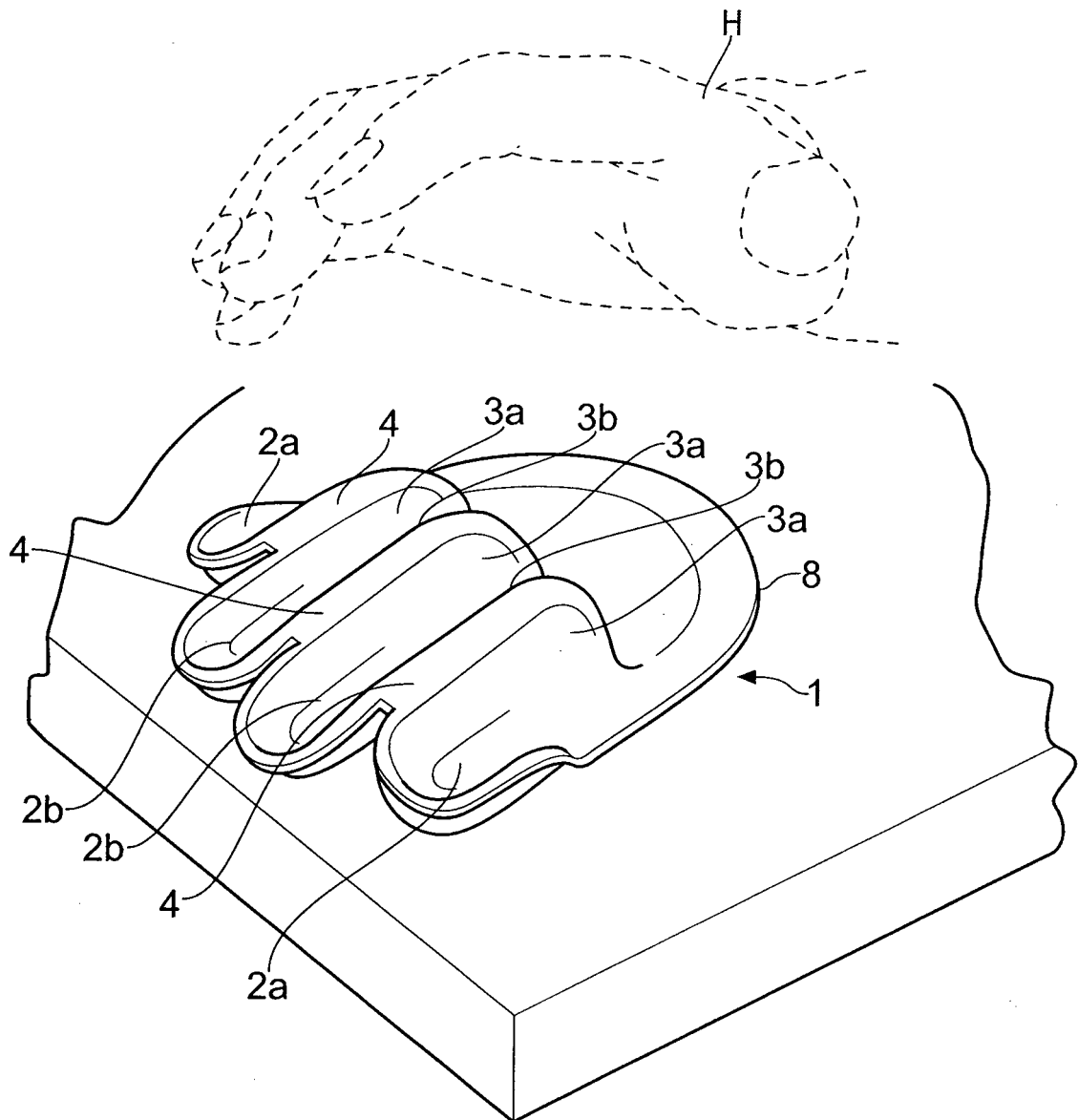


FIG. 1

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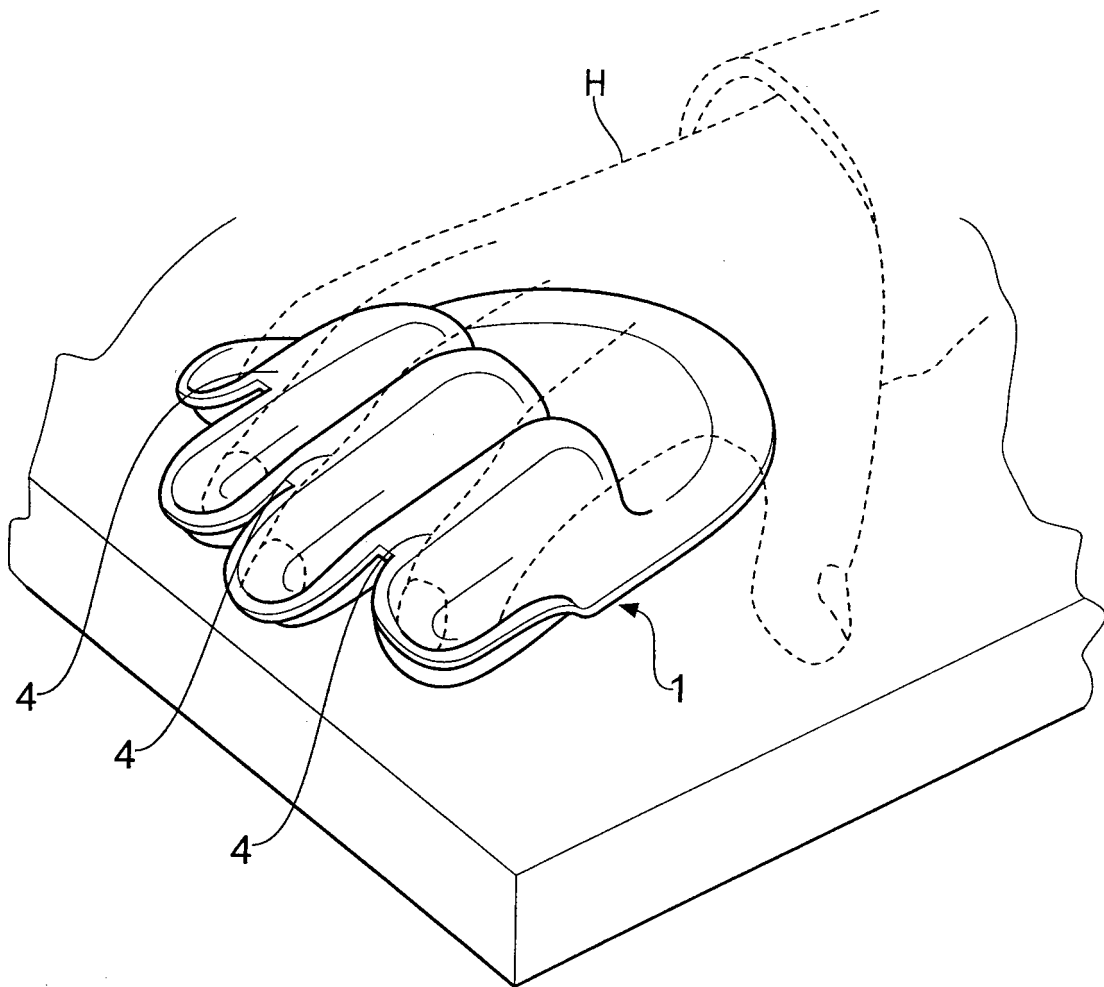


FIG. 2

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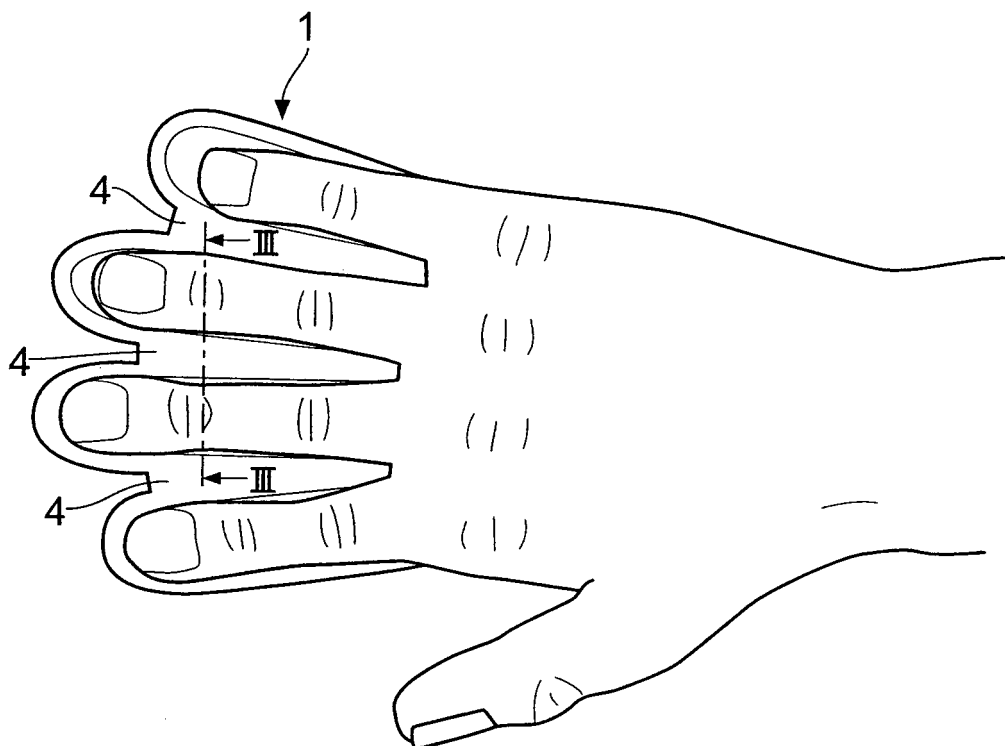


FIG. 3

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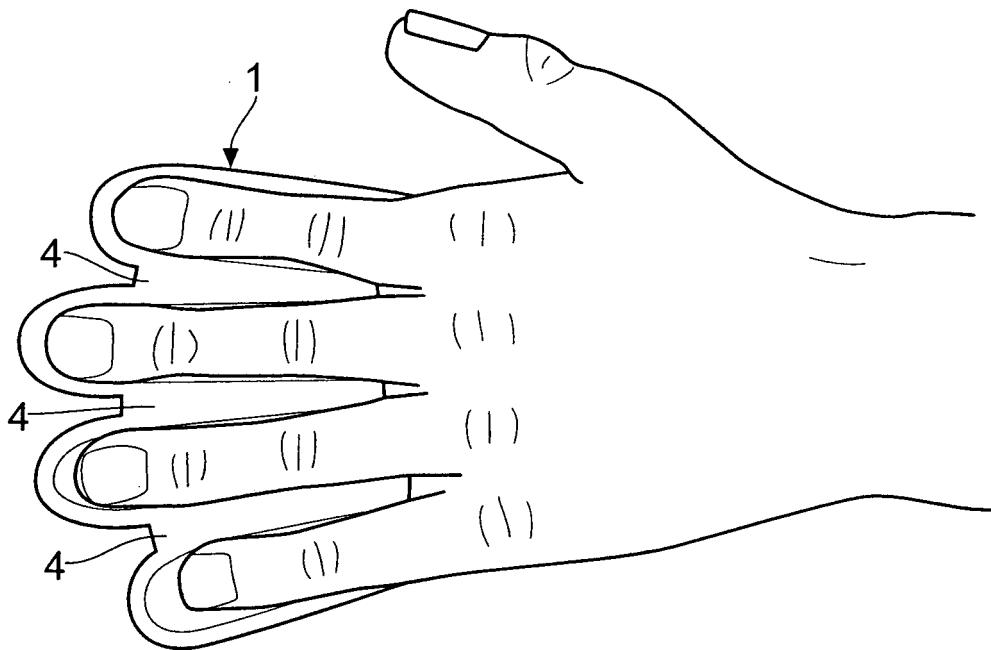


FIG. 4

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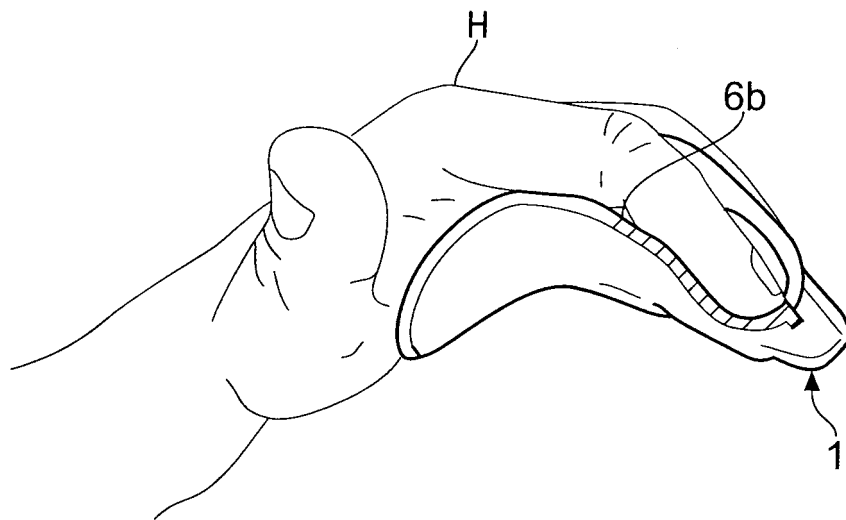


FIG. 5

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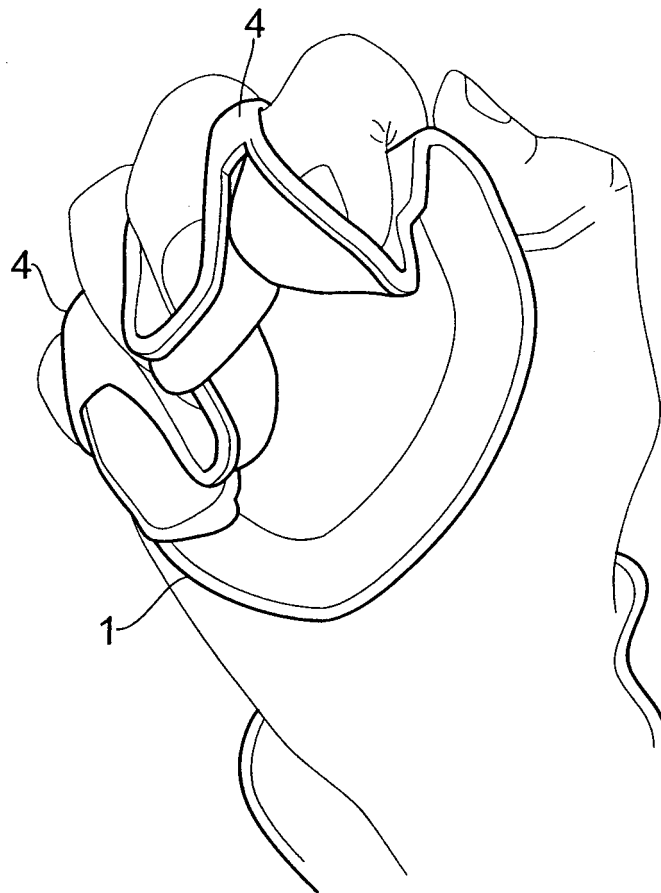


FIG. 6

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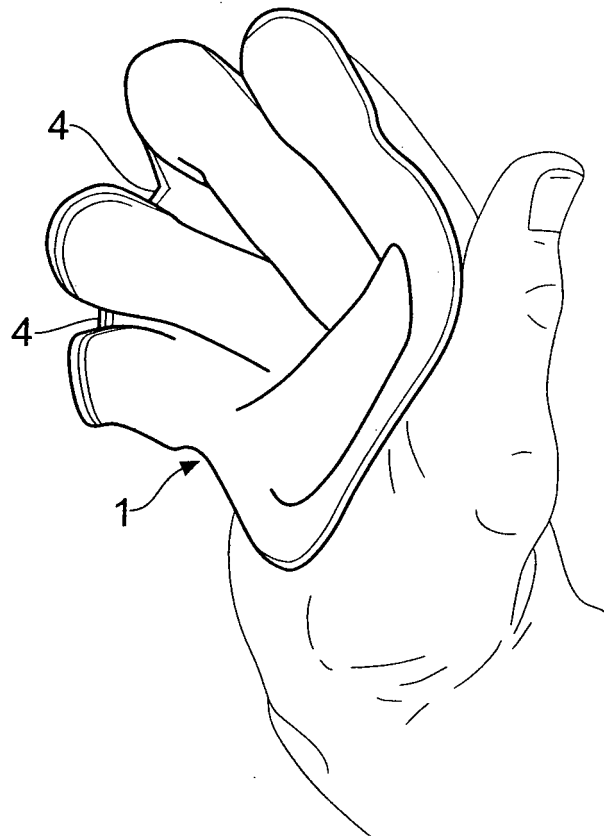


FIG. 7

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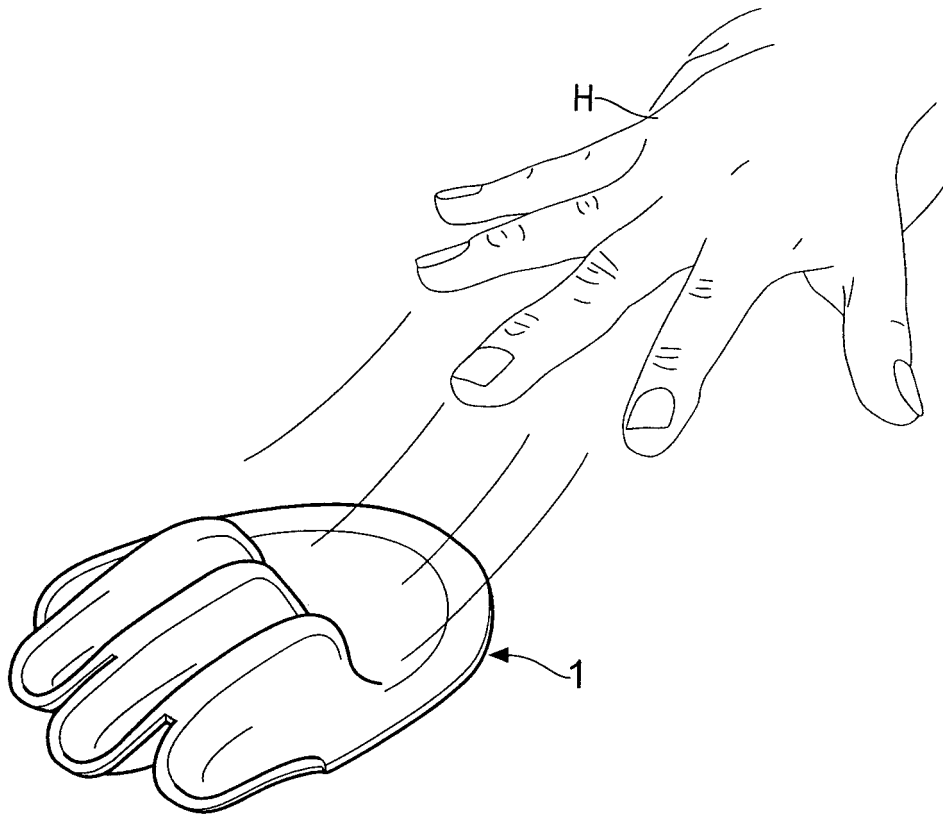


FIG. 8

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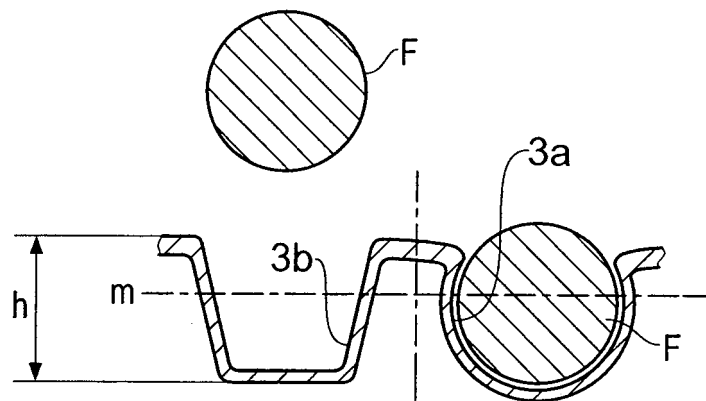


FIG. 9A

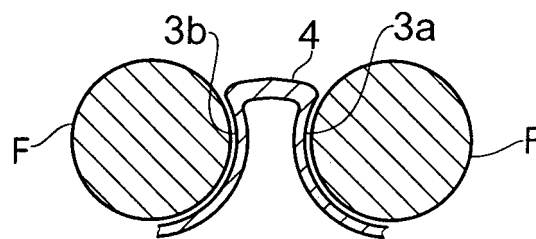


FIG. 9B

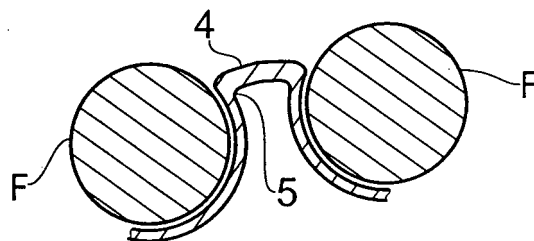


FIG. 9C

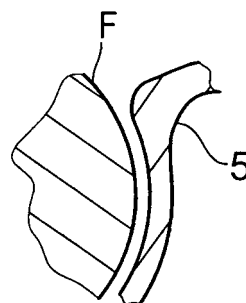


FIG. 9D

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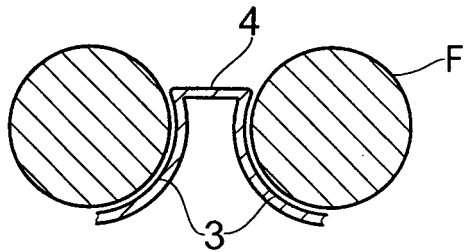


FIG. 9E

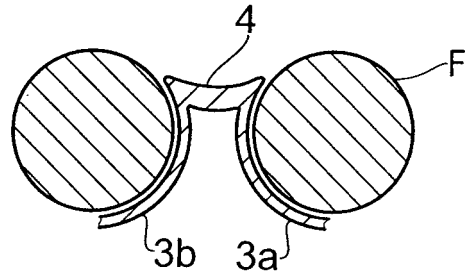


FIG. 9F

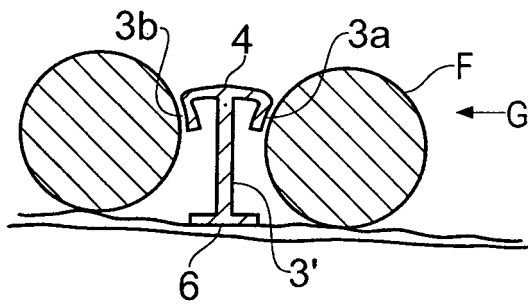


FIG. 9G

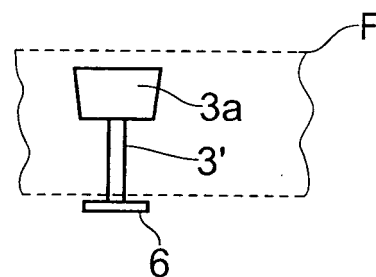


FIG. 9H

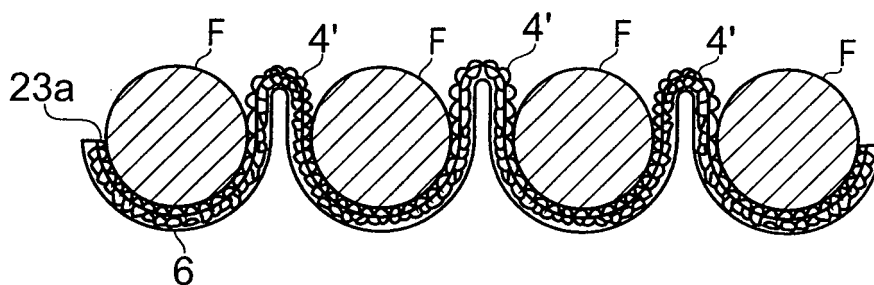


FIG. 9I

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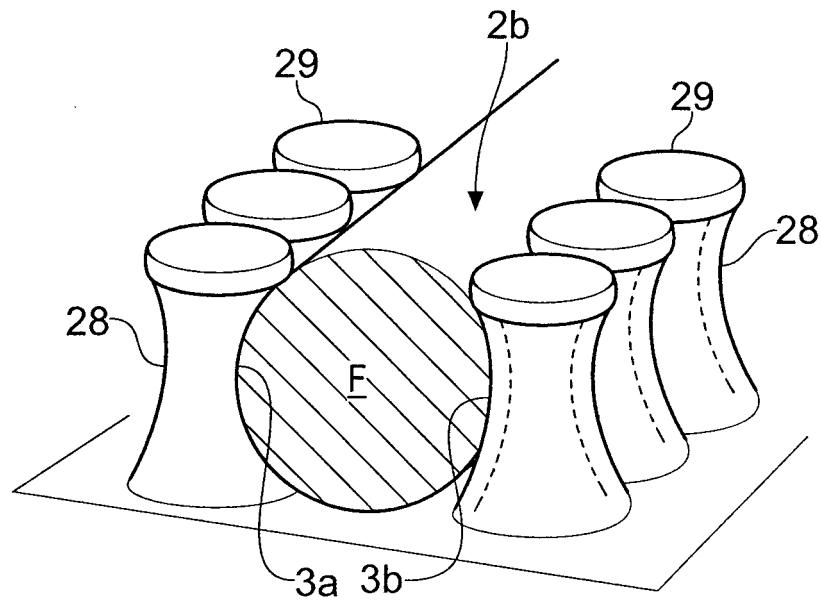


FIG. 9K

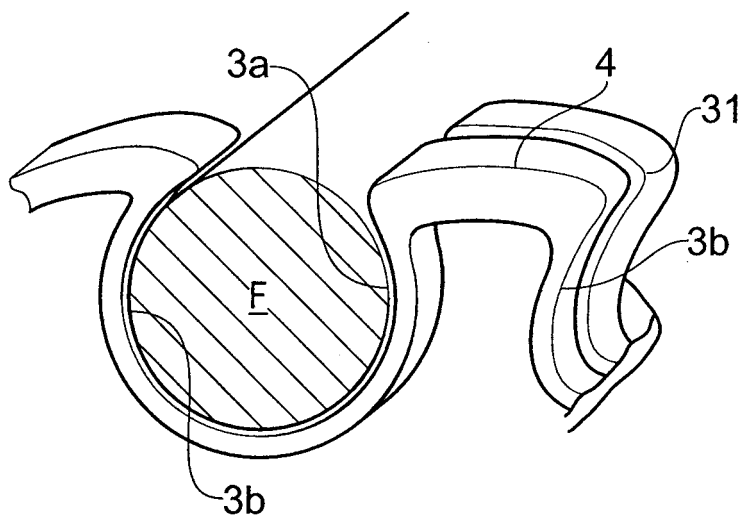


FIG. 9L

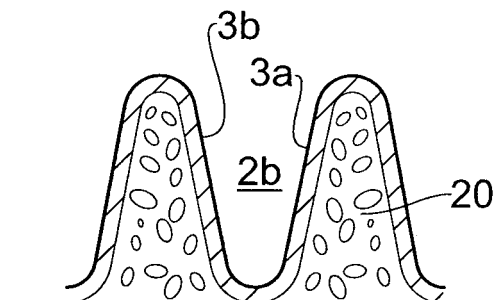


FIG. 9J

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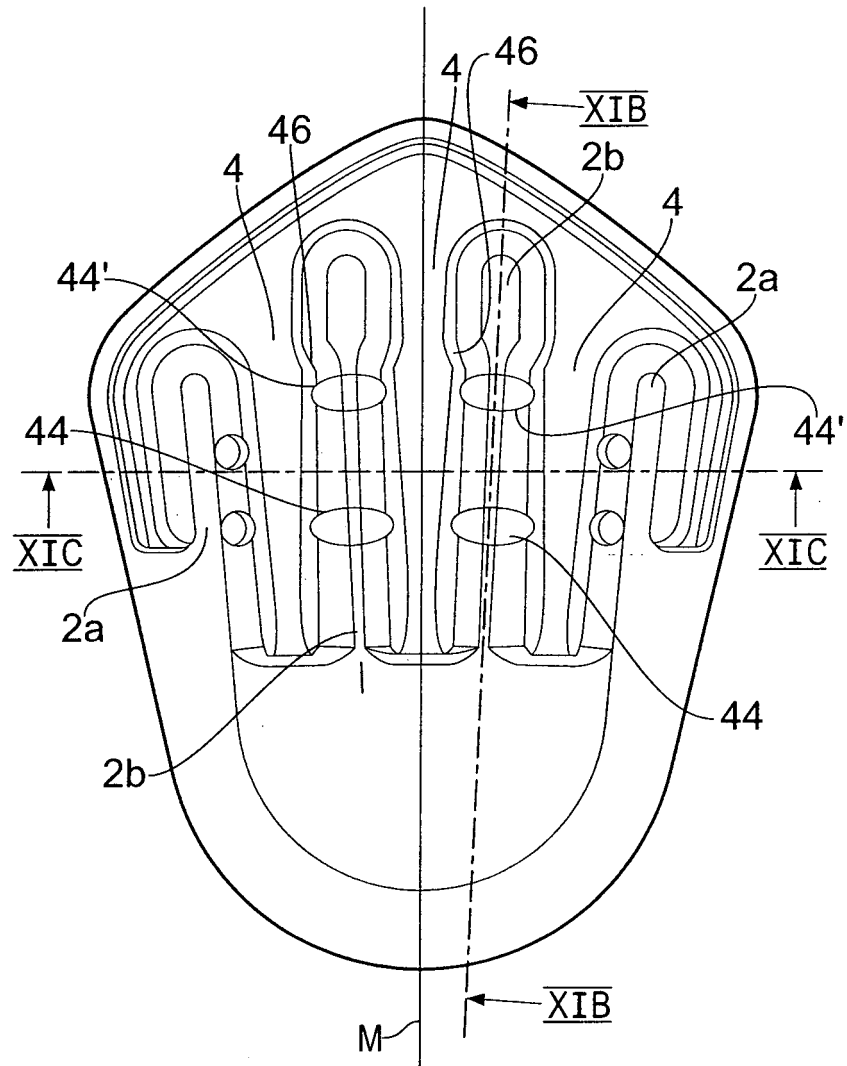


FIG. 10A

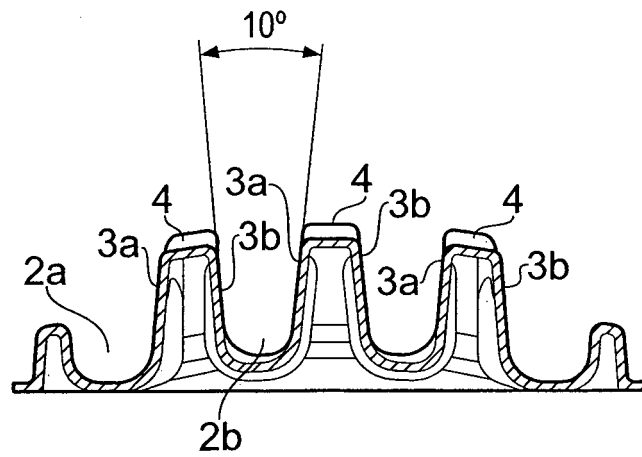


FIG. 10C

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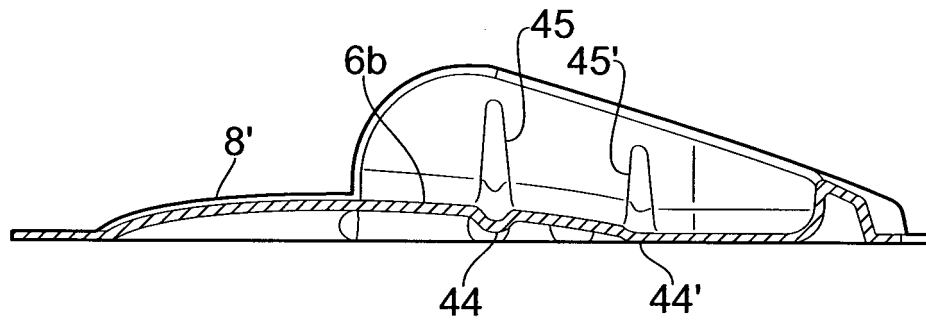


FIG. 10B

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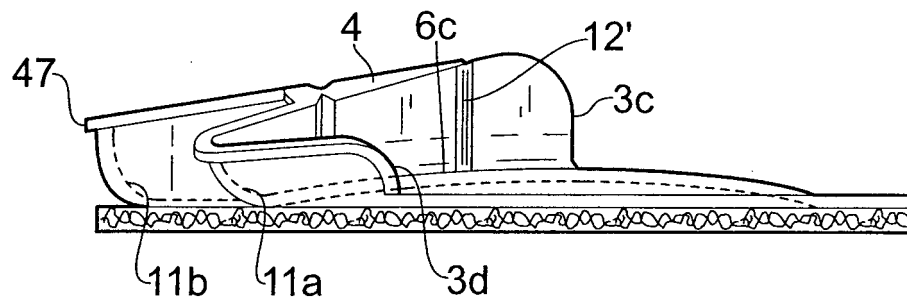


FIG. 11A

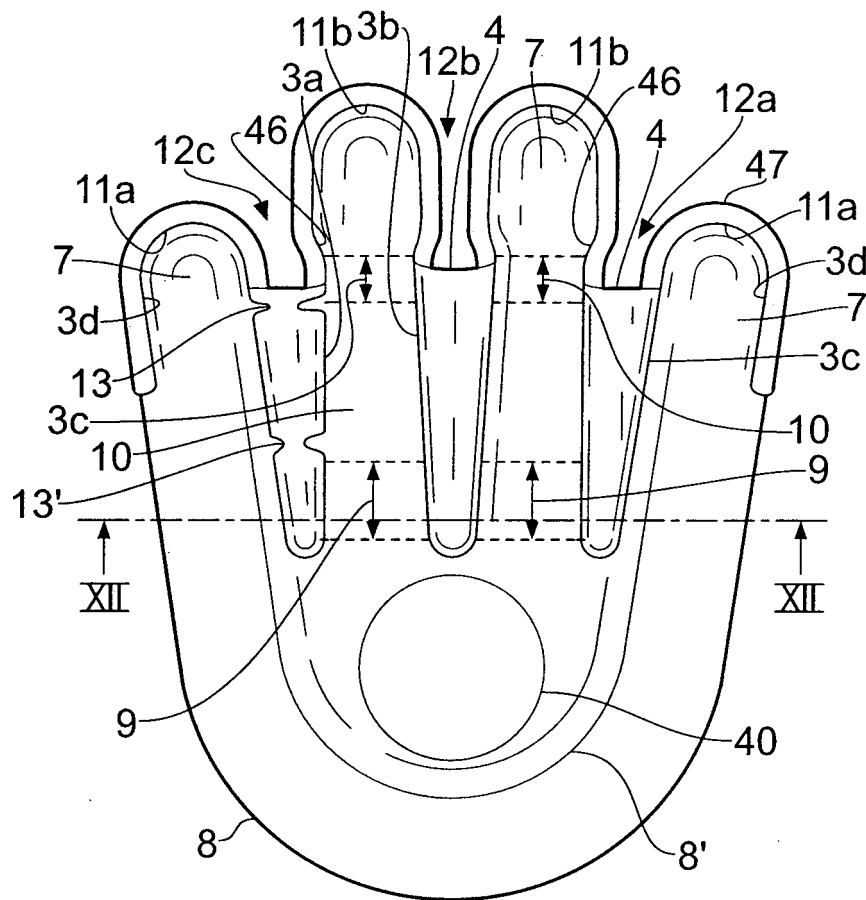


FIG. 11B

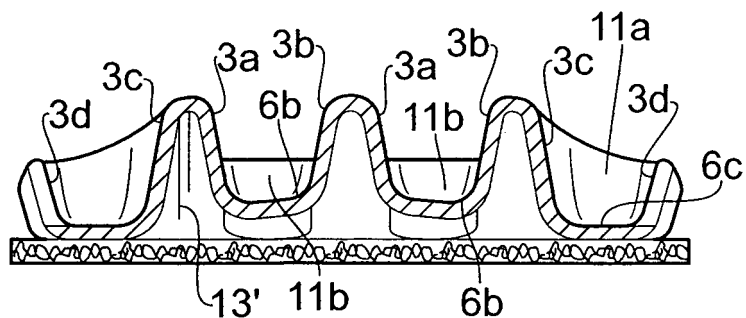


FIG. 11C

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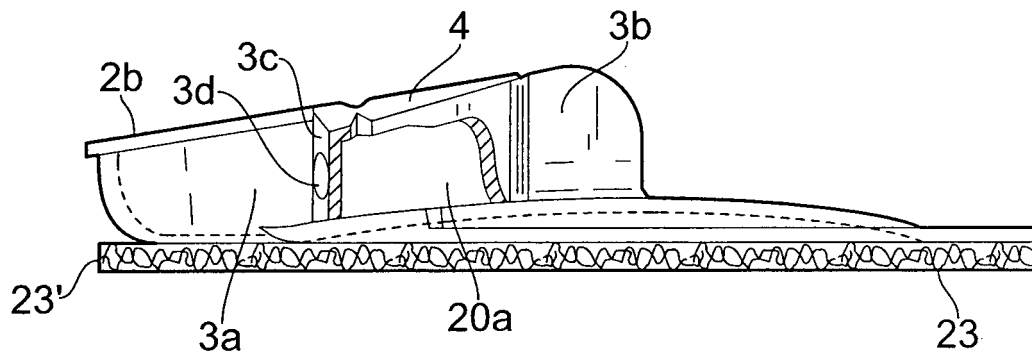


FIG. 11D

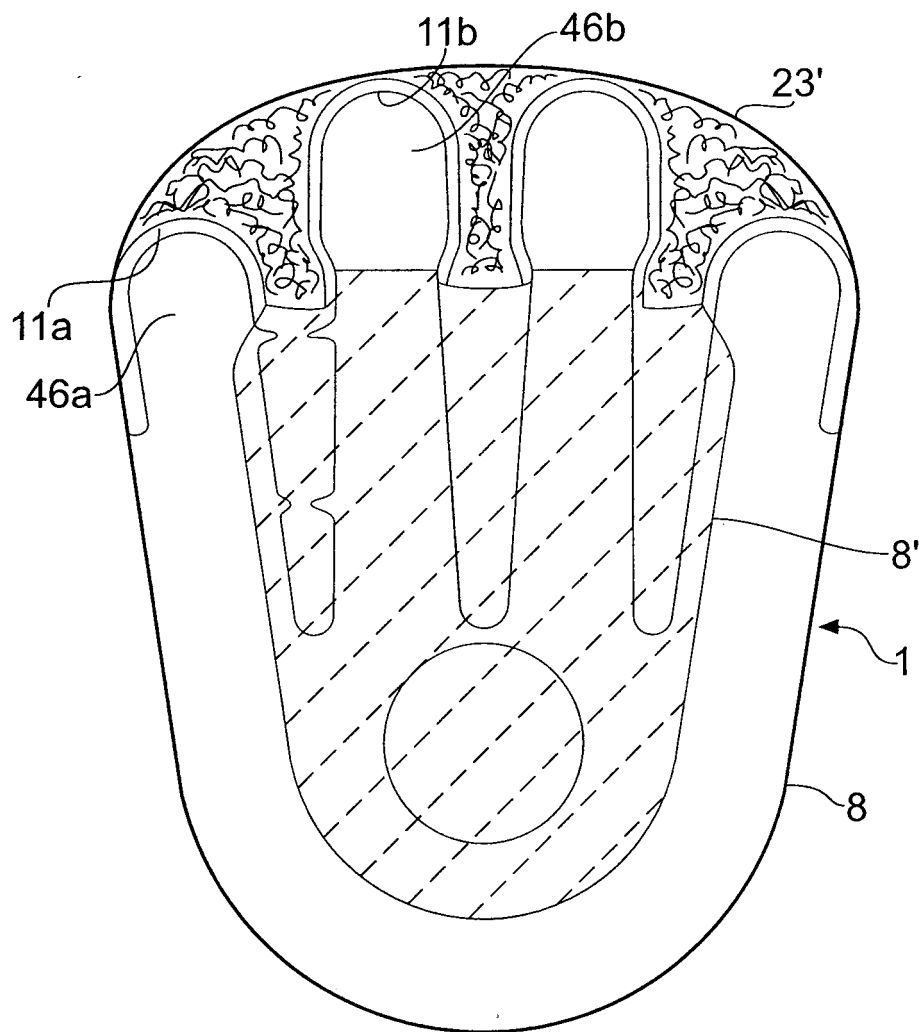


FIG. 11E

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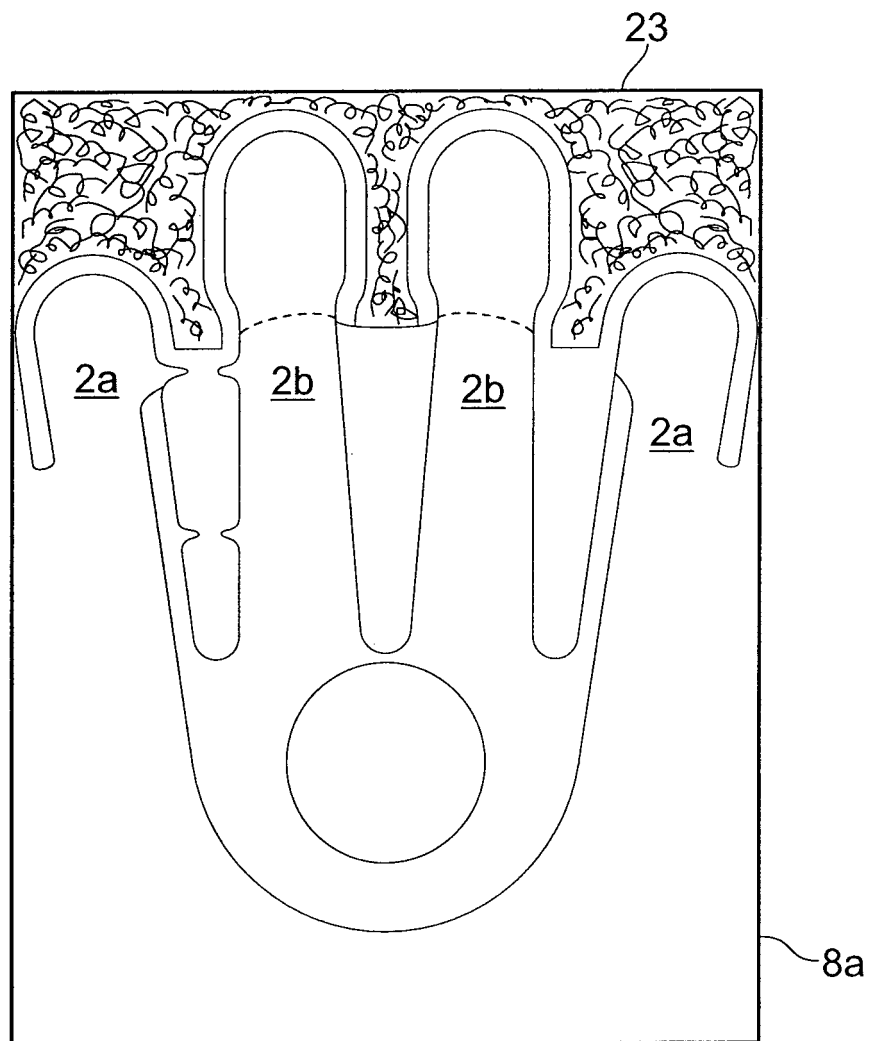


FIG. 11F

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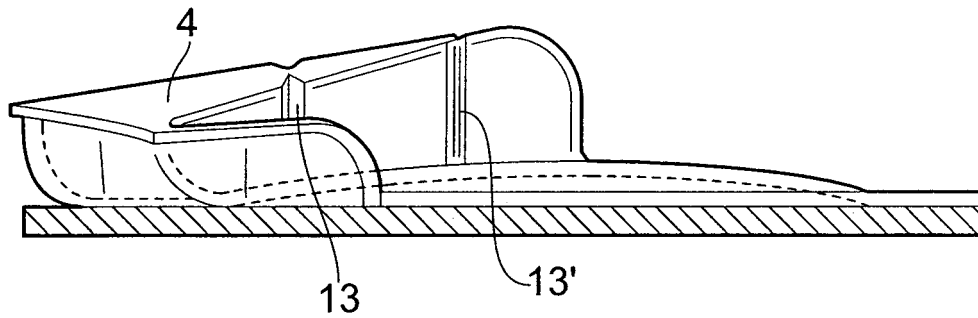


FIG. 13A

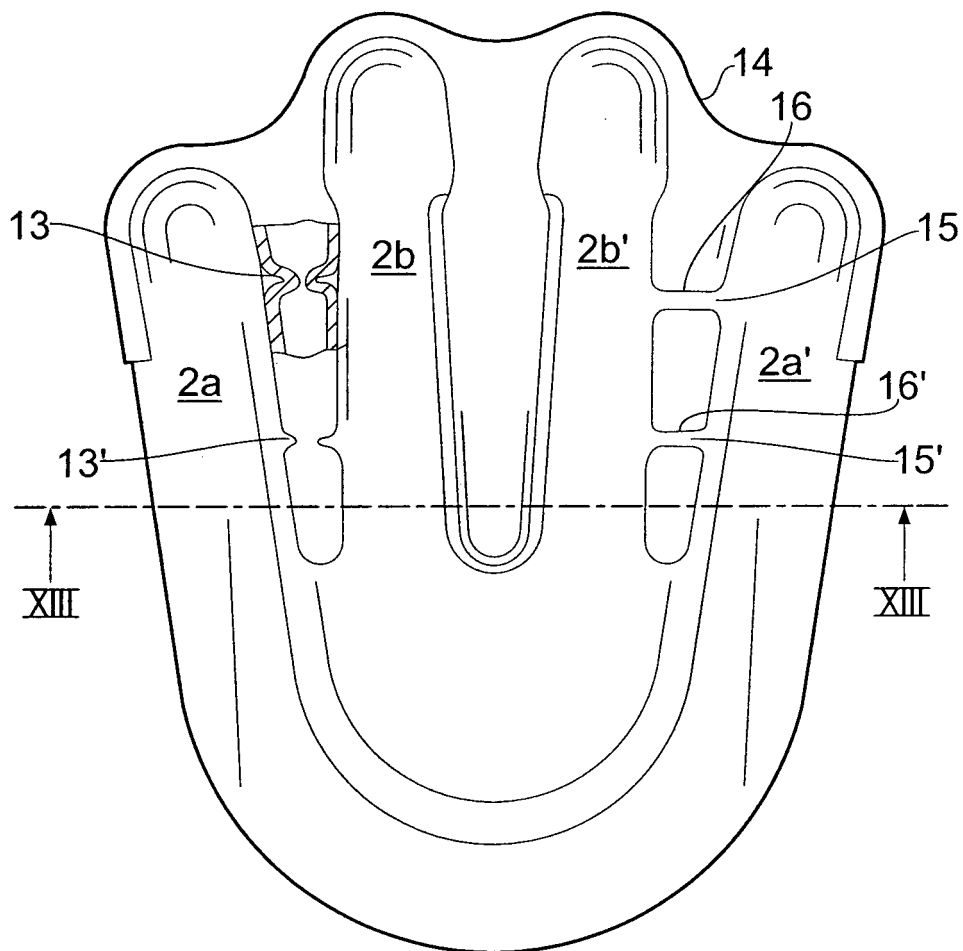


FIG. 13B

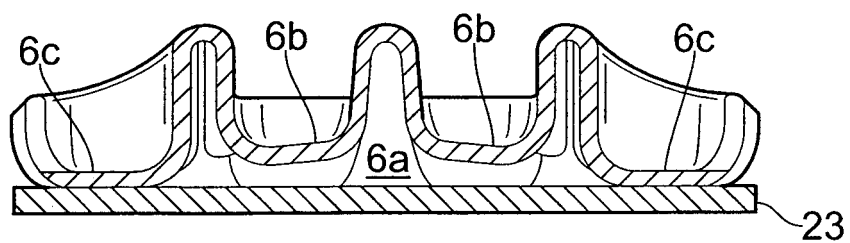


FIG. 13C

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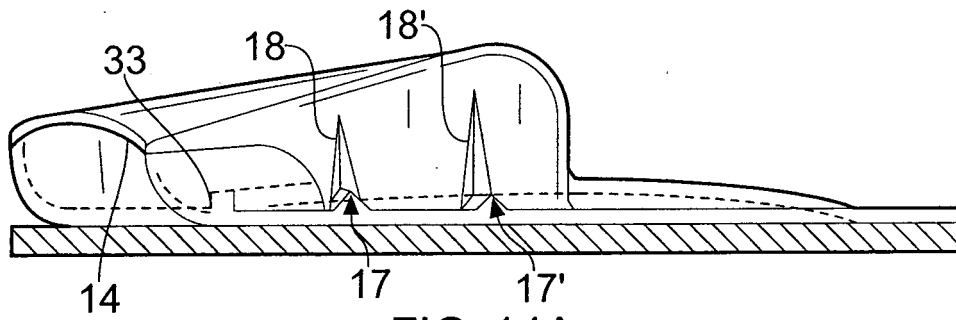


FIG. 14A

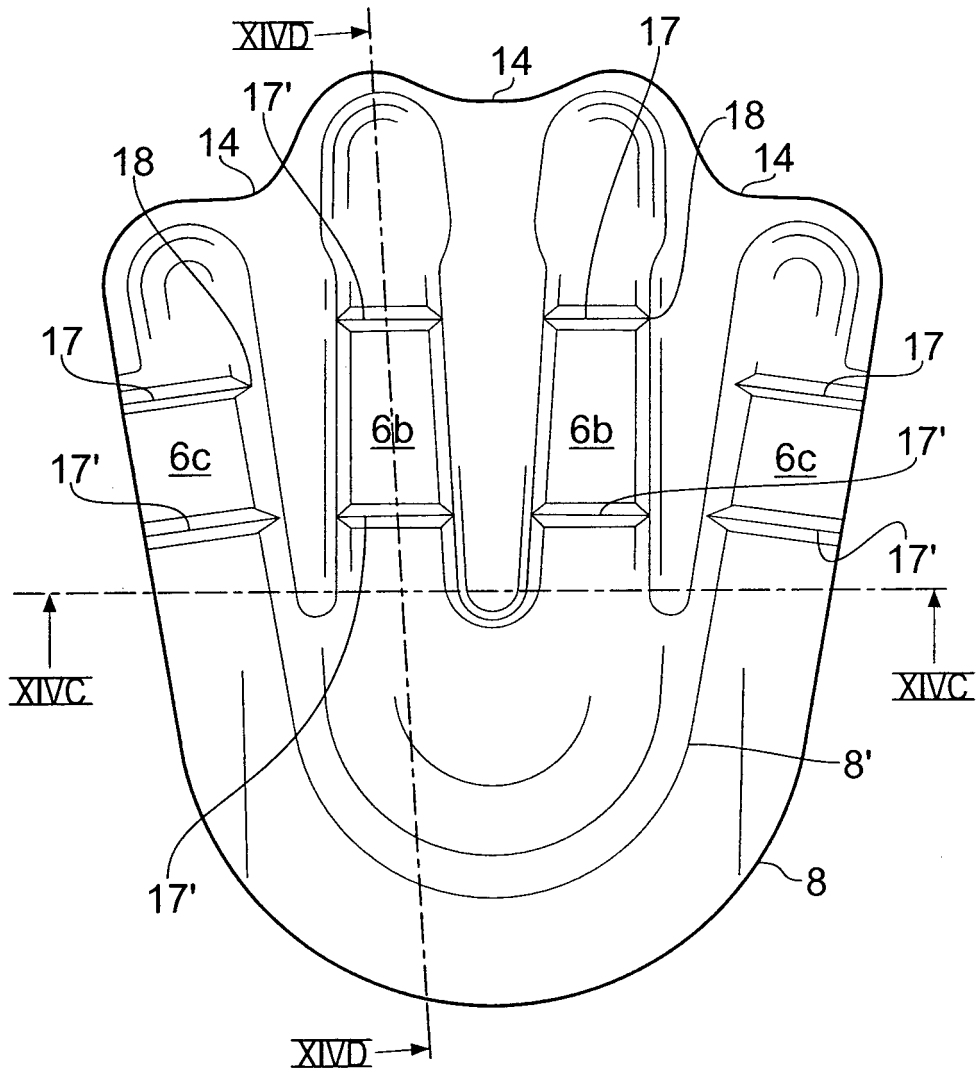


FIG. 14B

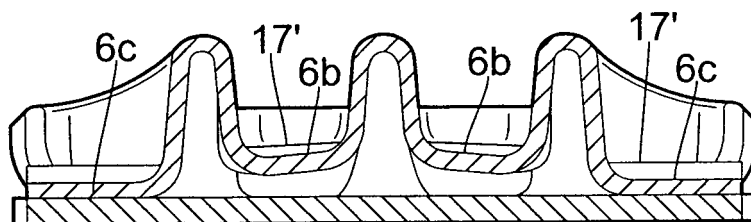


FIG. 14C

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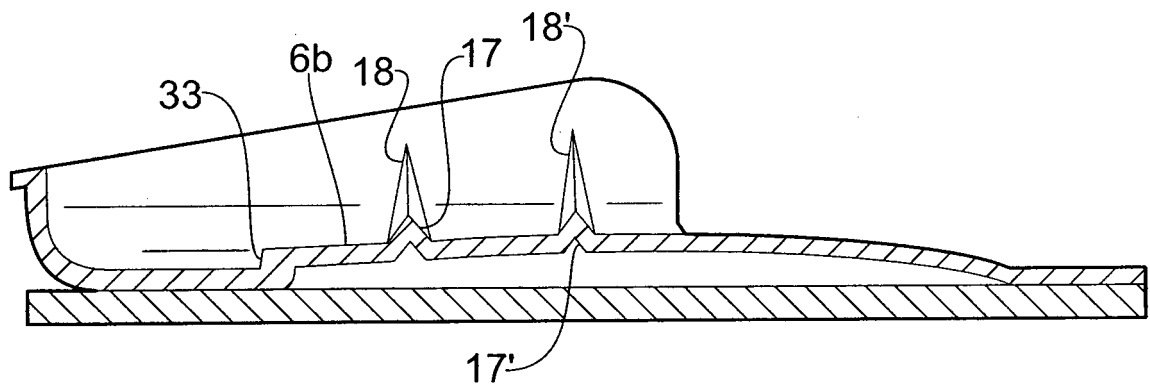


FIG. 14D

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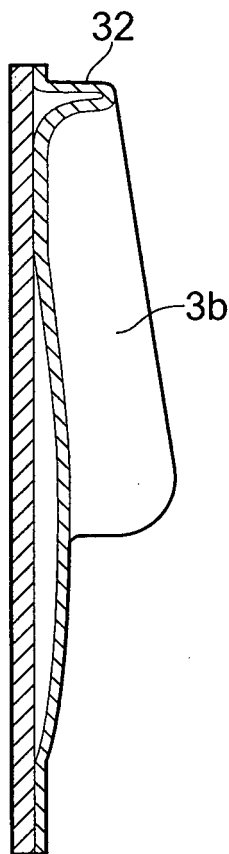


FIG. 15B

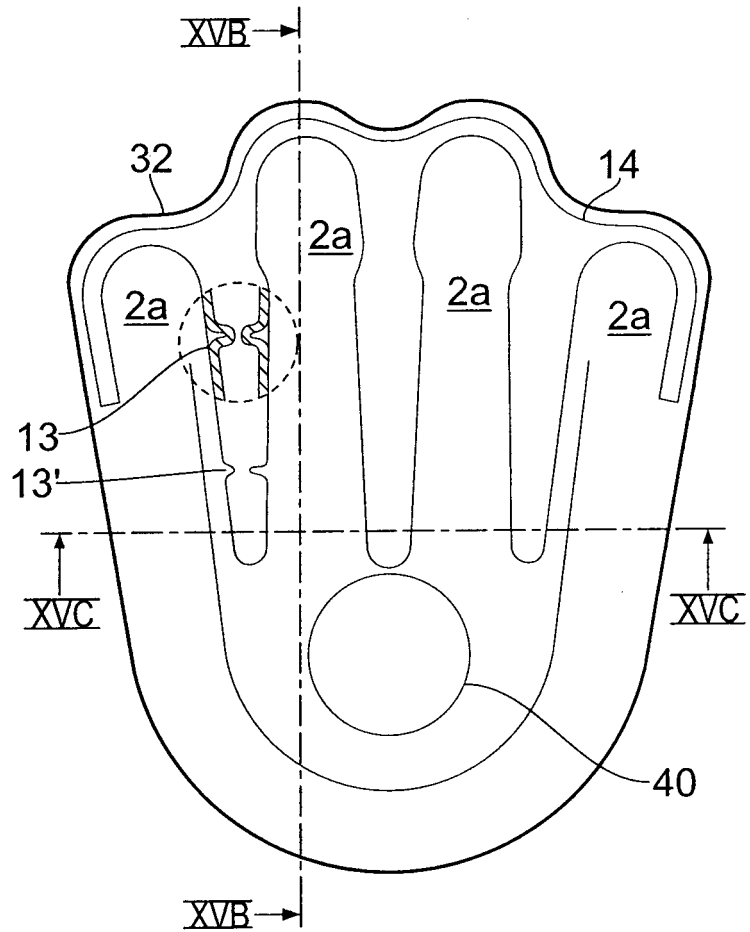


FIG. 15A

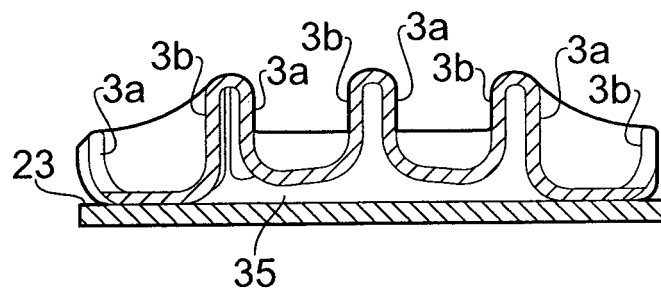


FIG. 15C

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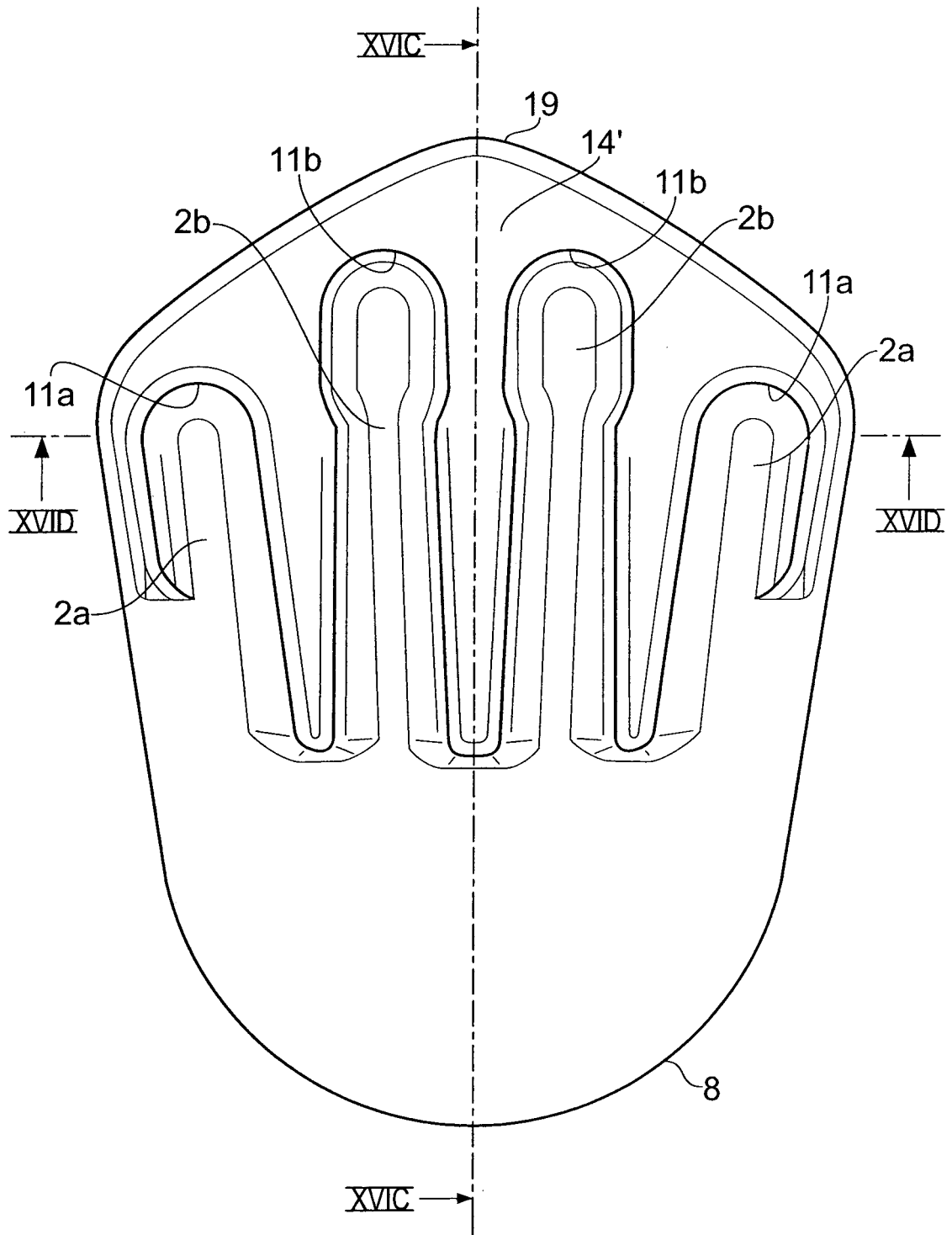


FIG. 16A

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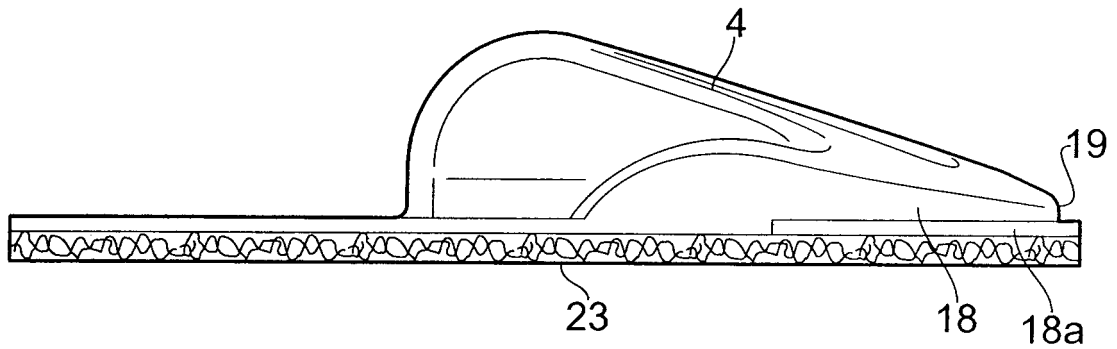


FIG. 16B

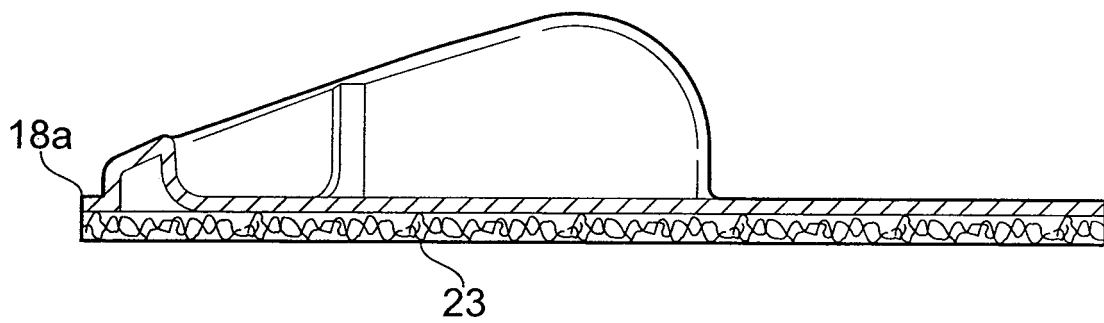


FIG. 16C

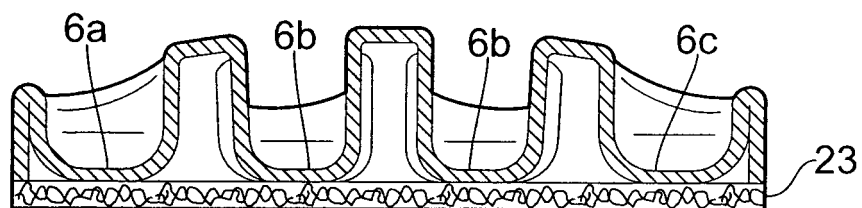


FIG. 16D

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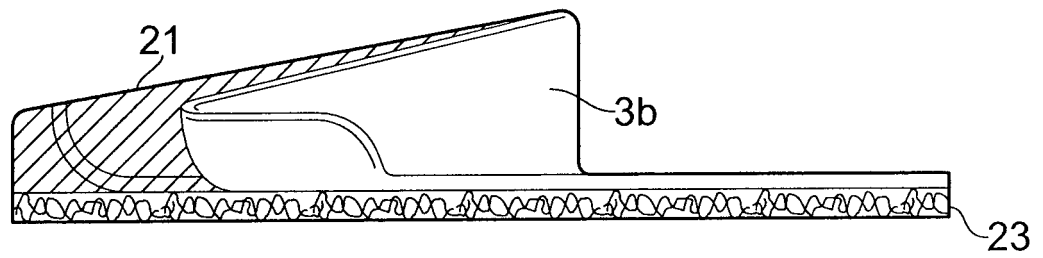


FIG. 17A

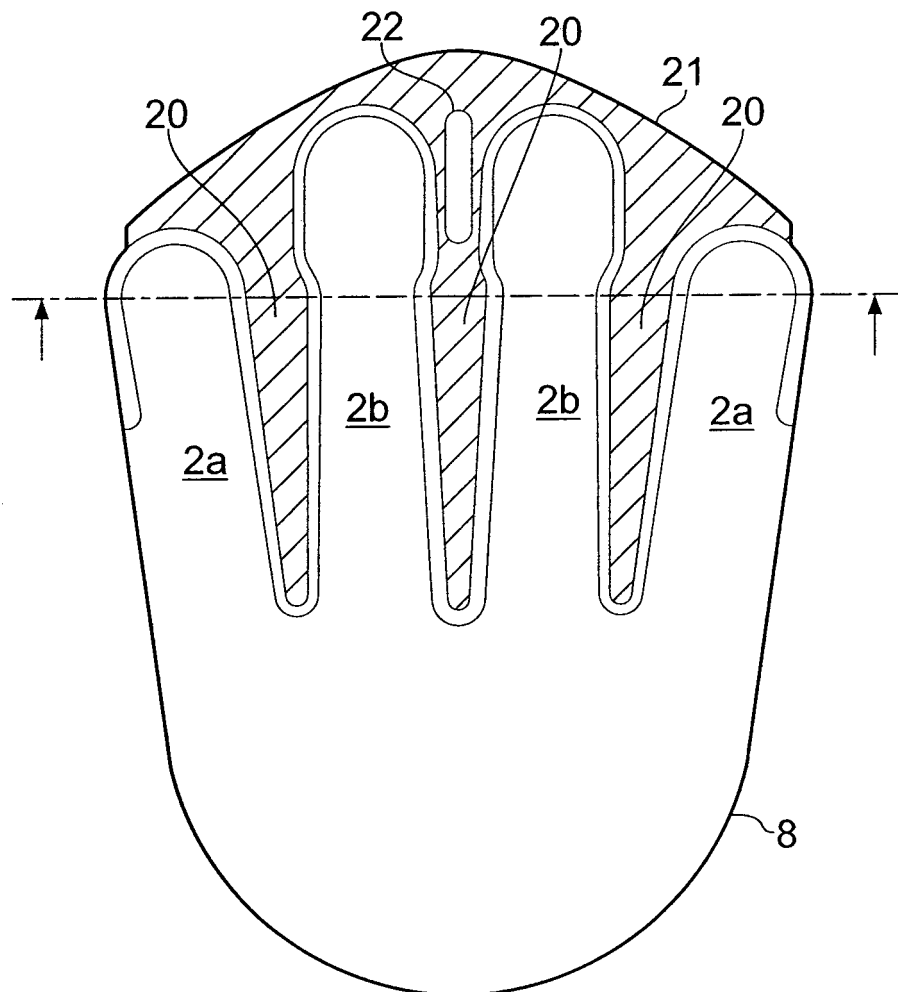


FIG. 17B

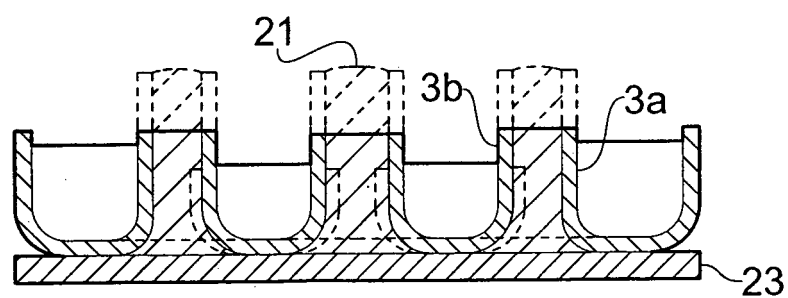


FIG. 17C

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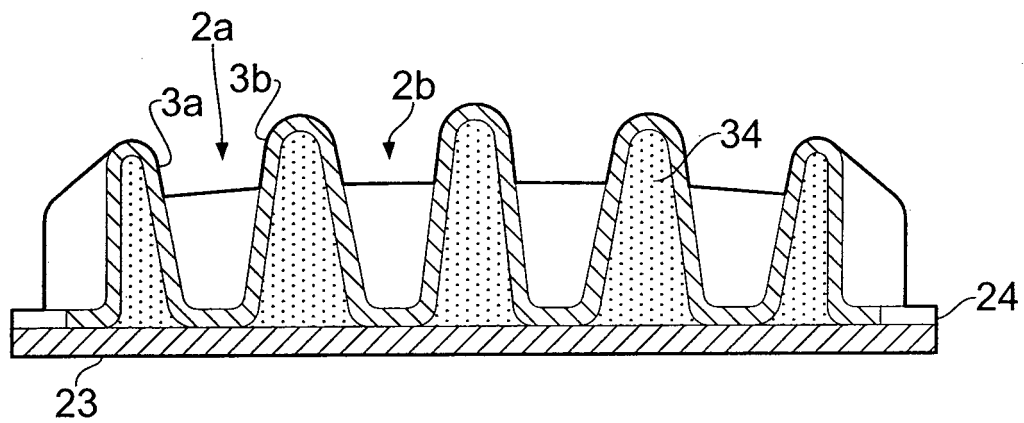


FIG. 18A

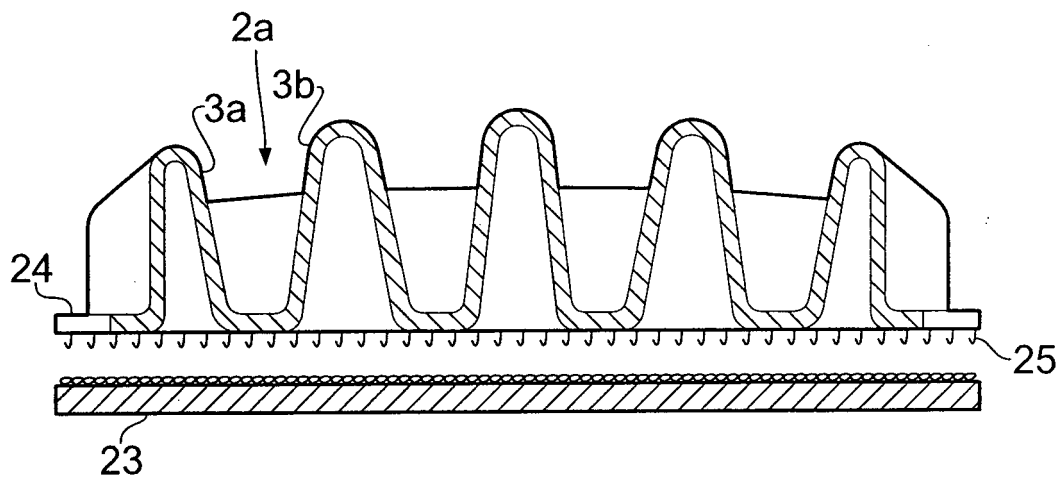


FIG. 18B

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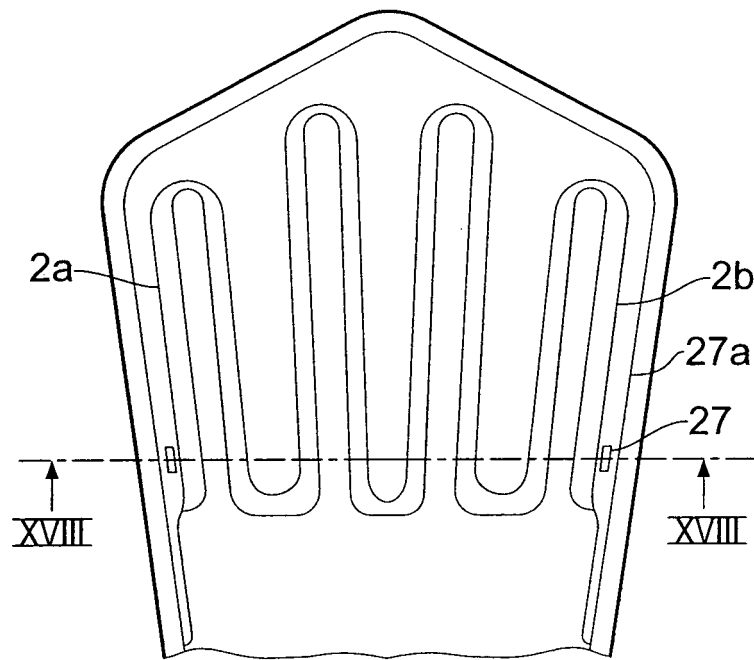


FIG. 18C

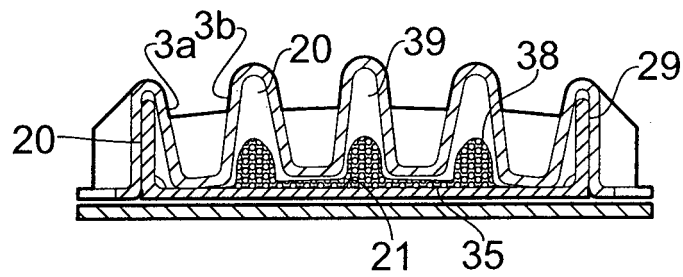


FIG. 18D

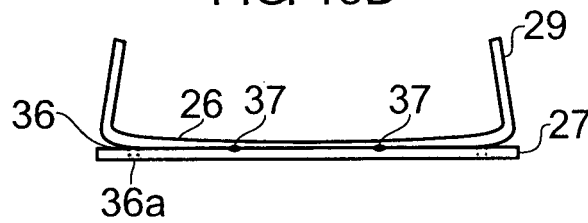


FIG. 18E

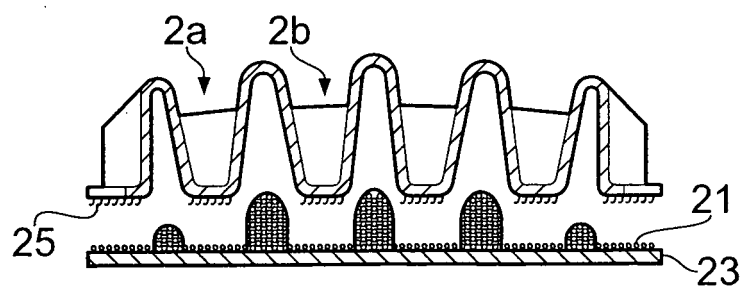


FIG. 18F

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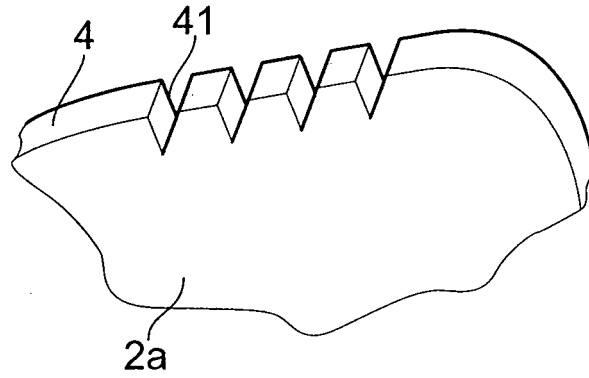


FIG. 19A

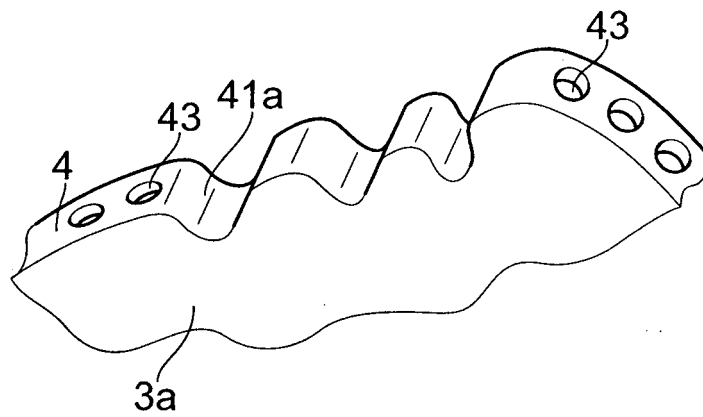


FIG. 19B

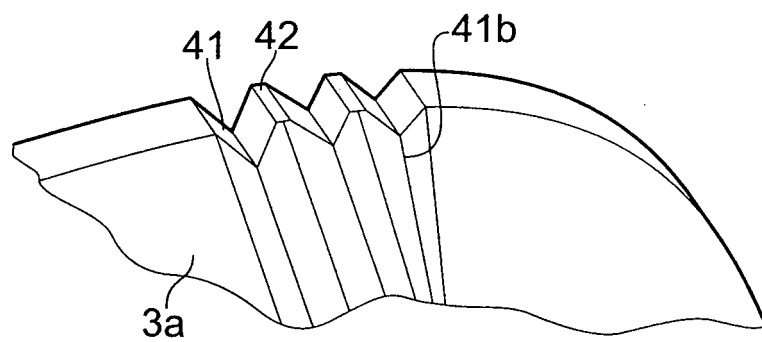


FIG. 19C

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2007/002528

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47L13/16 A47L13/18

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)

A47L A01K A41D A45D A46B A47K A61B A63B B24D

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004/098365 A (SWITCHKEY INTELLECTUAL PROPERT [GB]; POWELL MICHAEL CHARLTON [GB]) 18 November 2004 (2004-11-18) cited in the application claims; figures	1-65,75
X		66-74,76
A	US 2 223 204 A (SIMS CARMICHAEL RUTH) 26 November 1940 (1940-11-26) page 2, lines 30-45; figure 5	1-65,72, 75,76
X		66-71, 73,74
A	WO 95/31923 A (RAWLINGS STEPHEN ANTHONY [GB]) 30 November 1995 (1995-11-30) page 4, line 21 - page 5, line 33; figure 4	1-65,75
X		66-71, 73,74,76

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

26 October 2007

Date of mailing of the international search report

13/11/2007

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Lopez Vega, Javier

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2007/002528

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2004098365	A	18-11-2004	EP 1617749 A2 US 2007174998 A1	25-01-2006 02-08-2007
US 2223204	A	26-11-1940	NONE	
WO 9531923	A	30-11-1995	AU 2531895 A	18-12-1995