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(54) Title: A FLAT FOLD FILTERING FACE PIECE MASK, AND METHOD OF MANUFACTURING THEREOF

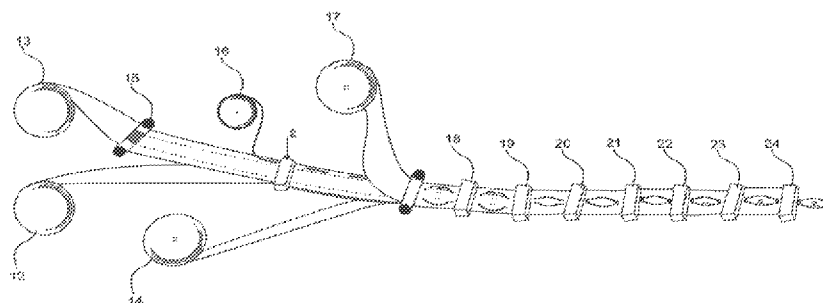


Fig. 5

(57) Abstract: The invention relates to a flat fold filtering face piece mask, a fish like shape and method of manufacturing thereof. The said mask comprising a central base 1, top flap 2 and bottom flap 3 made up of a single panel formed by of materials at least one layer of spun bond layer which is the cover media, at least one layer of fine filtration media, at least one non-woven layer capable of being stiff by heat & press, and at least one spun bond layer which is the outside cover media. The said top flap 2 and bottom flap 3, respectively, is sealed by fold-line, seam, weld or bond 5 to the central base 1 at the upper line 7 from start region 10, 11 of the central base till the where the dotted weld starts (side region).



TITLE:-

A FLAT FOLD FILTERING FACE PIECE MASK, AND METHOD OF MANUFACTURING THEREOF

FIELD OF THE INVENTION:-

The present invention relates, a flat fold filtering face piece mask, in general, to a respiratory device and more particularly, to a flat fold filtering face piece with single panel having composite layers where the one layer of the central base is treated to provide a stiff central base and soft top and bottom flap and the single panel is held together with the help of dotted weld.

BACKGROUND OF THE INVENTION:-

Filtrating respirators or face masks are used in a wide variety of applications when it is desired to protect a human's respiratory system from particles suspended in the air or from unpleasant or noxious gases. Generally such respirators or face masks are of one of two types a molded cup-shaped form or a flat-folded form. The flat-folded form has advantages in that it can be carried in a wearer's pocket until needed and re-folded flat to keep the inside clean between wearings. The flat-folded form of face mask may have a stiffening element to hold the face mask away from contact with the wearer's face. Stiffening has also been provided by fusing a pleat across the width of the face mask in a laminated structure or by providing a seam across the width of the face mask.

US6123077 discloses a respiratory device showing a method where complete welding or seaming is done to central portion with the first region and second region. This invention discloses an additional manufacturing step of adding stiffener layer to the central panel to hold the face mask away from wearers face.

US5701892 discloses a multipurpose face mask made of supple material that covers the nose, mouth, and chin with a two sided chamber held away from the entrance of the nostrils and the mouth by a rigid support attached inside the vertical front fold. This rigid support makes possible the use of a wide variety of soft materials in one or more layers, which may serve to filter dust, pollen, mold, dander, powder, and other common airborne particles, and/or to warm and humidify cold, dry air.

US6394090 discloses a device that includes a stiffener layer. The first portion and the third portion are substantially free of the stiffener layer.

US3971369 discloses a body portion **22** comprising of an upper part **24**, a lower part **26**, and a generally central part **25** there between. Central part **25** is folded backwardly about a vertical crease or fold line **52** which divides it in half, this fold line, when the mask is worn, being in substantial alignment with an imaginary vertical line passing downwardly through the center of the wearer's forehead, his nose, and the center of his mouth.

US20080011303 discloses a flat-fold respirator made from a stiff filtration panel sealed to the remainder of the respirator through at least one line of demarcation. The panel contains a porous mono component monolayer nonwoven web that contains charged intermingled

continuous mono component polymeric fibers of the same polymeric composition and that has sufficient basis weight or inter-fiber bonding so that the web exhibits a Gurley Stiffness greater than 200 mg and the respirator exhibits less than 20 mm H₂O pressure drop. The respirator may be formed without requiring additional stiffening layers, bicomponent fibers, or other reinforcement and can be flat-folded for storage. Scrap from the manufacturing process may be recycled to make additional stiff filtration panel web.

In prior art it is known that the central base should be stiff. The central, top and bottom flap is made stiff by adding a stiffener layer, by creasing, by addition of metal or stiff fabric thereby increasing the manufacturing step. In this particular invention the filtering face piece is made of a single panel and the central base is heat and pressure or ultrasonic treated to form a stiff area thereby reducing the manufacturing step of adding a stiffener layer. In prior inventions soft skin comfort material like foam is used to make the top flap and bottom flap soft. In prior arts the manufacturing steps of forming the mask does not provide integrity during formation.

OBJECT OF THE INVENTION:-

The object of the invention is to reduce the manufacturing cost and time by using combination of heat and pressure or ultrasonic treatment to stiffen central base at the mouth of the wearer by treating a one layer of composite layers during manufacturing which prevents the use of an additional stiffener layer and thus reducing a manufacturing step. Another advantage is it provides soft feel at the top flap and bottom flap at the nose and chin of the wearer.

Another object of the invention is to eliminate soft skin comfort material like foam at the top flap and bottom flap.

Another object of the invention is to maintain integrity of fabric by avoiding shifting and joining.

Another object of the invention is to provide a perfect fit of the respiratory device such that the respiratory device is identical like fish shaped when in folded/closed form for easy storage in pocket and beetle stiff fit, when in open form providing the benefit of an air chamber over the nose and mouth of the wearer with minimum air leak.

Another object of the invention is to make the mask of a single panel made of composite layers where it reduces the manufacturing step of joining the separate panels together shown in prior arts.

STATEMENT OF INVENTION:-

Accordingly invention provides a flat fold filtering face piece mask, a fish like shape, comprising a central base **1**, top flap **2** and bottom flap **3** made up of a single panel formed by of materials at least one layer of spun bond layer which is the cover media, at least one layer of fine filtration media, at least one non-woven layer capable of being stiff by heat & press, and at least one spun bond layer which is the outside cover media; the said top flap **2** and bottom flap **3**, respectively, is sealed by fold-line, seam, weld or bond **5** to the central base **1** at the upper line **7** from start region **10**, **11** of the central base where the dotted weld starts (side region).

REFERENCE TO DRAWING:-

Invention is described with reference to accompanying drawings wherein,

Figure 1 shows the plan view of the face mask of according to invention with base on top facing;

Figure 2 shows the plan view of the face mask of according to invention with flaps on top facing;

Figure 3 shows the plan view of the mask of according to invention with flaps opened ready wear;

FIG.4 is an illustration of the single panel of the face piece mask shown in a state when the top flap **2** and bottom flap **3** are not sealed by fold-line, seam, weld or bond **5** at the side region of the upper line **7** and lower line **9** of the central base **1** and there is dotted weld and is in teared open state showing the single panel formation or assembly of the top flap **2**, bottom flap **3** with the central base **1**.

Figure 5 shows steps of process of manufacture of the face mask according to invention;

Figure 6 shows trimming of extra portion layer in step 19;

Figure 7 shows the trimmed portion in figure 6 removed;

Figure 8 showing welding of stage 21;

Figure 9 showing second trimming stage 22 to form face mask;

Figure 10 shows complete face mask according to invention.

SUMMARY OF THE INVENTION:-

This invention discloses a flat fold personal filtering face piece mask made up from composite layers of a single panel.

The non-woven layer of the central base from composite layers is treated with heat and pressure or ultrasonically during manufacturing process to make it stiff at central base position only, which is capable to make air chamber over the nose and mouth during wearer.

This heat treatment of the central base which is performed during the manufacturing step, further reduces the manufacturing cost and also reduces one stage in the manufacturing process of adding a stiffener layer.

The top flap and bottom flap are sealed to the central base to form a fish shape like formation of the respiratory mask while in folded form, and later provides the wearer with the "off the face" chambered benefits of a molded cup-shaped (fish shape) respiratory mask when the wearer wears it.

The manufacturing steps include that a single panel composite layers from which one layer from composite layer is heat and pressure or ultrasonically treated. Then the composite layers are dot welded in the middle region and welded to form outer sides of the top flap and bottom flap, then the mask is trimmed, the top flap and bottom flap is folded on the central base, the folded flaps are then welded at the upper and lower lines and further trimmed to form a complete mask.

BREIF DESCRIPTION OF FIGURES:-

This invention discloses a flat fold personal filtering face piece mask made up from single panel composite layers welded together.

FIG.1 and FIG.2 shows a front view of flat-fold personal filtering face piece to be worn on the face, which is a fish like shape when in folded form for storage, and which has a central base **1**, top flap **2** and bottom flap **3** made up of a single panel. The top flap **2** is sealed by fold-line, seam, weld or bond **5** to the central base **1** at the upper line **7** from start region **10**, **11** of the central base till the where the dotted weld starts (side region) and bottom flap **3** is sealed by fold-line, seam, weld or bond **5** to the central base at the lower line **9** from start region **10**, **11** of the central base till where the dotted weld starts (side region).

Also shown are attachment means **25** such as a bead and staple on the central base **1** for attaching, for example, a head band to hold the face piece mask in place on a wearer's face.

FIG.2 is an illustration of the back view of personal face piece mask which shows the top flap **2** and bottom flap **3** folded to store in a pocket of the wearer when not in use.

The face piece mask as shown in FIG.1 is shown in FIG. 3, in its open, ready-to wear configuration having the general shape of a flat somewhat fishlike shaped formation when closed which later forms a fish fit when opened shown in FIG.3 and provides the wearer with the "off-the-face" chambered and stiff benefits of a molded cup-shaped mask with minimum air leak.

The materials that are used in the formation of the face piece mask are made of various layers.

- A) There is at least one layer of spun bond layer which is the cover media.
- B) There is at least one layer of fine filtration media.
- C) There is at least one non-woven layer capable of being stiff by heat & press.
- D) There is at least one spun bond layer which is the outside cover media.

The non-woven layer of the central base is treated with heat and pressure or ultrasonically to provide stiff central base before it is joined with the other layers to form a composite face piece mask at the manufacturing process.

Due to the heat and pressure treatment of the nonwoven layer of the central base 1 only, the face piece mask at the central base at the mouth of the wearer provides a stiff region at the entire central base 1 only and at the same provides a soft fill at top and bottom flap at the nose, chin of the wearer. This heating and pressure or ultrasonic treatment at only one layer of the central base reduces a manufacturing step of adding an extra stiffener layer. Also this stiff central base increases the depth of the area at the central base thus preventing sticking of the central base at the lips and thereby reducing moisture, fogging and bacteria formation inside the mask when it is worn.

The face piece mask can be of various shapes if required.

The upper line **7** of central base and the lower line **9** of central base **1** are curved like fish shape. The middle region **8** of central base **1** upper line **7** and lower line **9** is preferably sealed by dot welding **4** to the top flap **2** and bottom flap **3**.

The dotted welding **4** prevents delaminating of the central base **1** when it is worn by the wearer.

In an embodiment, optionally there can be a nose clip which fits on the first member either inside or outside the layers. Optionally there can be a valve in the center for exhalation of the air from inside the chamber.

FIG.4 is an illustration of the single panel of the face piece mask shown in a state when the top flap **2** and bottom flap **3** are not sealed by fold-line, seam, weld or bond **5** at the side region of the upper line **7** and lower line **9** of the central base **1** and there is dotted weld and is in teared open state showing the single panel formation or assembly of the top flap **2**, bottom flap **3** with the central base **1**.

In an embodiment, for better degree of jaw movement or for improvement in fit at the nose bridge there can be a widthwise fold or pleat that can be formed at the top flap **2** or bottom flap **3** of the face piece mask.

In another embodiment, the central portion of the central base **1** which is directly in contact with the mouth and nose of the wearer can form substantially square shaped chamber.

In another embodiment, the middle region of the central base can form substantially square shaped chamber due to at least one welding pattern formed in the central portion.

In another embodiment the two side flaps top **2** and bottom **3** is welded with the central base **1** of the face piece mask leaving the middle region **8** of the central base where it is not welded or dot welded. This provides a folding of the flaps at the middle region **8** of the central base on both sides. This gives a stiff off the face lift central portion of the central base away from the nose and mouth of the wearer providing a comfortable fit.

Since there is no stiff region at the top **2** and bottom **3** flaps of the face piece mask it will provide a soft feel and provide an easy fit at the nose and chin of the wearer. There will be an optionally embedded nose clip inside the face piece mask. The soft fill at the flaps avoids use of nose foam or any additional nose cushioning material and thus provides a soft touch feel at the chin and the nose forming a perfect soft fit avoiding hard material discomfort to the wearer. There will optionally be a valve attached for exhalation of inhaled air on the middle of the face face piece mask.

This provides with the benefit of good fit, soft comfort and good skin comfort for persons wearing it under highly challenging situations like skin sweat. The non-woven layer is primary filter or body of the face piece mask. The other layer can be cover layer (Spun bond) or fine filter layers, all of them substantially textile non-woven fabric.

In another embodiment, one layer of this composite could be modified for hydrophobicity, hydrophilicity or high water absorbency. The

hydrophobicity and water absorbency helps in cold weather and high altitude for entrapping moist air and/or giving warmth for user benefits. It is known that the high water absorbency layer is good for cold and nose blockage. The hydrophilic layer is suitable for topical climate weathers.

FIG.5 is an illustration of the production process of manufacturing. The face filtering face piece has multiple layers in which the at least one fine filtration media and at least one nonwoven fiber are positioned in between the at least one spun bond layers. The process comprises of manufacturing stages where all the layers are laid one above the other and the face piece mask forms altogether a single panel.

But before the non-woven layers meets the other layers to form a composite face piece mask the non-woven layer is stiffened on the central base of the face piece mask using a heat treatment and pressure or ultrasonic sealing.

This reduces the manufacturing step of adding a stiffener material/layer between the spun bond layers at the manufacturing stop.

Thus when all the at least four layers are sealed/welded together the nonwoven layer will form a stiff central base where it is in contact with the nose and mouth of the wearer maintaining the soft fill at the top and bottom flaps and also at the same time the stiff central base will create off the face chamber due to the unique shape of the mask, to provide a convenient and comfortable breathing space in the middle region of the central base.

MANUFACTURING PROCESS ACCORDING TO THE PRESENT INVENTION:-

FIG.5 shows the manufacturing process which consists of a construction of various layers, wherein there is as pun bond layer stage **14** which can be inner layer, there is fine filtration medialayerstage **12**, there is non-woven layer stage **13**, there is again a spun bond layer stage **17** which is outer layer, 16 is wire clip roll. Stage **2** is cutting of the wire clip and placing inside the composite layer.

A single panel composite layer is taken. The non-woven layer from the composite layer is treated with heat treatment and pressure or ultrasonically at stage **15** at the central base to make it stiff before it meets the other layers to form composite layers together having a stiff central base with greater depth so that the central base does not stick to the lips preventing moisture and fog accumulation of the wearer and allows a breathing space.

FIG.5 shows that, after all the composite layers are formed one above the other, the layers are at the first welding stage **18** (shown in FIG.5) where the edges **25, 30** (shown in FIG.4 and FIG. 6, FIG. 7) are welded which will later form the outer sides of the top flap and bottom flap, then the layers at first welding stage **18** (shown in FIG.5) are dot welded at the upper line and lower line at the middle region of the central base which will form the dot welding **31, 32** as shown in FIG.4 and FIG. 6.

The layers are then trimmed where extra material **33** (as shown in FIG.6) are first trimmed beside the edges **25, 30** as shown in FIG.7 on

both sides of the filtering face piece mask by putting them on first trim stage **19** (shown in FIG.5) which forms the top flap and bottom flap.

The trimmed top flap and bottom flap are folded on the dotted weld by passing them on folding stage **20** (shown in FIG.5) where the top flap **2** is folded on the central base **1** at the dotted weld **31** and bottom flap **3** is folded at the dot weld **32** on the central base **1**.

FIG.8 shows the weld **27** and **28** at the upper line **7** and lower line **9**. **FIG.9** displays the back view of the mask where the folds and edges **25**, **30** are visible. The filtering face mask is cut at the region **34** to divide the two masks in the manufacturing stage.

The layers pass on a second welding stage **21** after the folds are formed to form weld **27**, **28** (shown in FIG.8) and welded on side regions leaving the dotted weld **31**, **32** portion of upper line **7** and lower line **9** of the central base **1** where the welding takes place.

The sides are second trimmed by allowing the layers to pass through trim stage **22** (shown in FIG.5) and trimming the extra material **34** (shown in FIG.9) to form the complete mask.

The headband is attached on sides **10**, **11** at head band attachment stage **23** (shown in FIG.5). The personal respiratory protection mask is then packaged at packaging stage **24** (shown in FIG.5) to complete the manufacturing process.

FIG.10 shows the complete filtering face piece mask.

The single panel of the composite layer is shown in FIG.4. When the filtering face piece mask is teared open the dotted weld keeps the central base, top flap and bottom flap attached together making it a single panel. The welded sides **25,26,27,28, 29, 30** are displayed. Due to the single panel, the manufacturing step of forming three panels and then welding it separately as shown in prior art is avoided. The composite layers form into a single panel thereby forming a complete filtering face piece mask, thereby reducing manufacturing steps.

I CLAIM:-

1. A flat fold filtering face piece mask, a fish like shape, comprising a central base **1**, top flap **2** and bottom flap **3** made up of a single panel formed by of materials; at least one layer of spun bond layer which is the cover media, at least one layer of fine filtration media, at least one non-woven layer capable of being stiff by heat & press, and at least one spun bond layer which is the outside cover media; the said top flap **2** and bottom flap **3**, respectively, is sealed by fold-line, seam, weld or bond **5** to the central base **1** at the upper line **7** from start region **10**, **11** of the central base where the dotted weld starts (side region).
2. The face piece mask as claimed in claim 1 wherein optionally a nose clip which fits on the first member either inside or outside the layers.
3. The face piece mask as claimed in claims 1 and 2 wherein optionally a valve provided in the center for exhalation of the air from inside the chamber.
4. The face mask as claimed in claims 1 to 3 wherein a widthwise fold or pleat is formed at the top flap **2** or bottom flap **3** of the face piece mask for better degree of jaw movement or for improvement in fit at the nose bridge.
5. The facemask as claimed in claims 1 to 4 wherein the central portion of the said central base **1** which is directly in contact with the mouth and nose of the wearer formed substantially square shaped chamber.
6. The face mask as claimed in claim 5 wherein the middle region of the said central base formed substantially square shaped chamber due to at least one welding pattern formed in the central portion.
7. The face mask as claimed in claims 1 to 6 wherein the two side flaps top **2** and bottom **3** is welded with the central base **1** of the

face piece mask leaving the middle region **8** of the central base where it is not welded or dot welded to enable folding of flaps in middle region **8** of the said base on both sides.

8. Method of manufacturing face mask of claims 1 comprises steps
 - a. making single panel of composite layer formed by at least one layer of spun bond layer which is the cover media **14**, at least one layer of fine filtration media **12**, at least one non-woven layer **13** capable of being stiff by heat & press, and at least one spun bond layer which is the outside cover media **17**;
 - b. the said non-woven layer from the composite layer is treated with heat treatment and pressure or ultrasonically at stage **15** at the central base to make it stiff before it meets the other layers to form composite layers together having a stiff central base with greater depth so that the central base does not stick to the lips preventing moisture and fog accumulation of the wearer and allows a breathing space;
 - c. cutting a wire clip in stage **2** from wire roller and placing inside the said composite layer;
 - d. steps (a to c) the composite layers are formed one above the other, the layers are at the first welding stage **18** where the edges **25, 30** are welded which will later form the outer sides of the top flap and bottom flap, then the layers at first welding stage **18** are dot welded at the upper line and lower line at the middle region of the central base which will form the dot welding **31, 32**;
 - e. the layers of step (d) trimmed where extra material **33** are first trimmed beside the edges **25, 30** on both sides of the filtering face piece mask by putting them on first trim stage **19** which forms the top flap and bottom flap;

- f. the trimmed top flap and bottom flap in step(e) are folded on the dotted weld by passing them on folding stage **20** where the top flap **2** is folded on the central base **1** at the dotted weld **31** and bottom flap **3** is folded at the dot weld **32** on the central base **1**;
- g. the layers pass on a second welding stage **21** after the folds are formed to form weld **27**, **28** and welded on side regions leaving the dotted weld **31**, **32** portion of upper line **7** and lower line **9** of the central base **1** where the welding takes place;
- h. the sides are second trimmed by allowing the layers to pass through trim stage **22** and trimming the extra material **34** to form the complete mask;
- i. the headband is attached on sides **10**, **11** at head band attachment stage **23**;
- j. the personal respiratory protection mask is then packaged at packaging stage **24** to complete the manufacturing process.

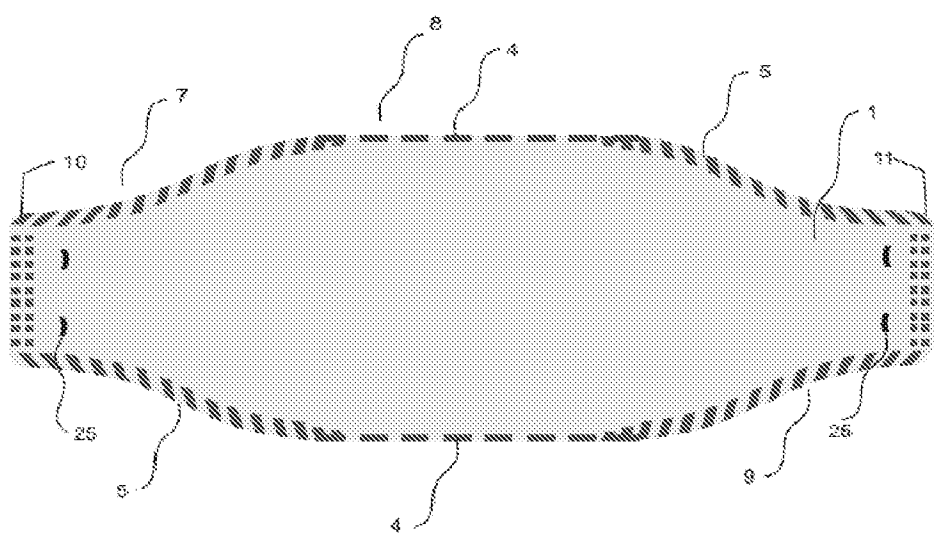


Fig. 1

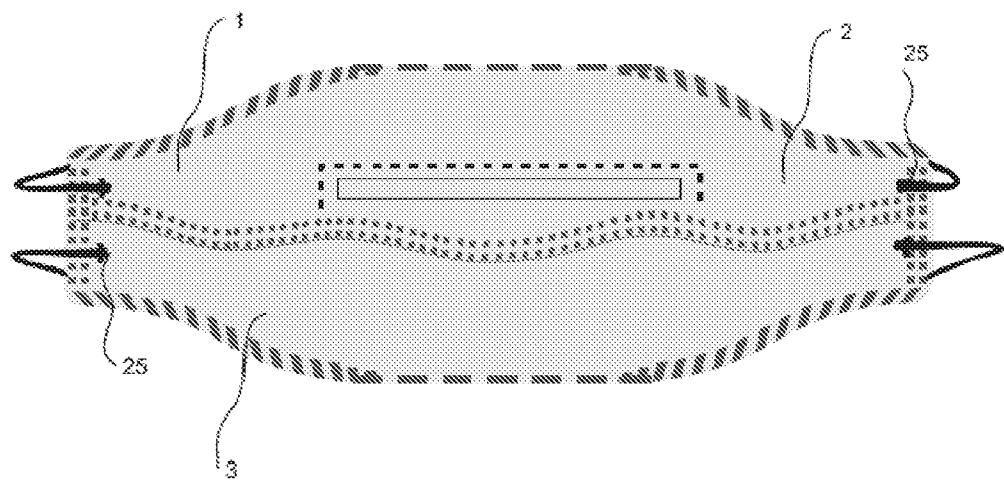


Fig. 2

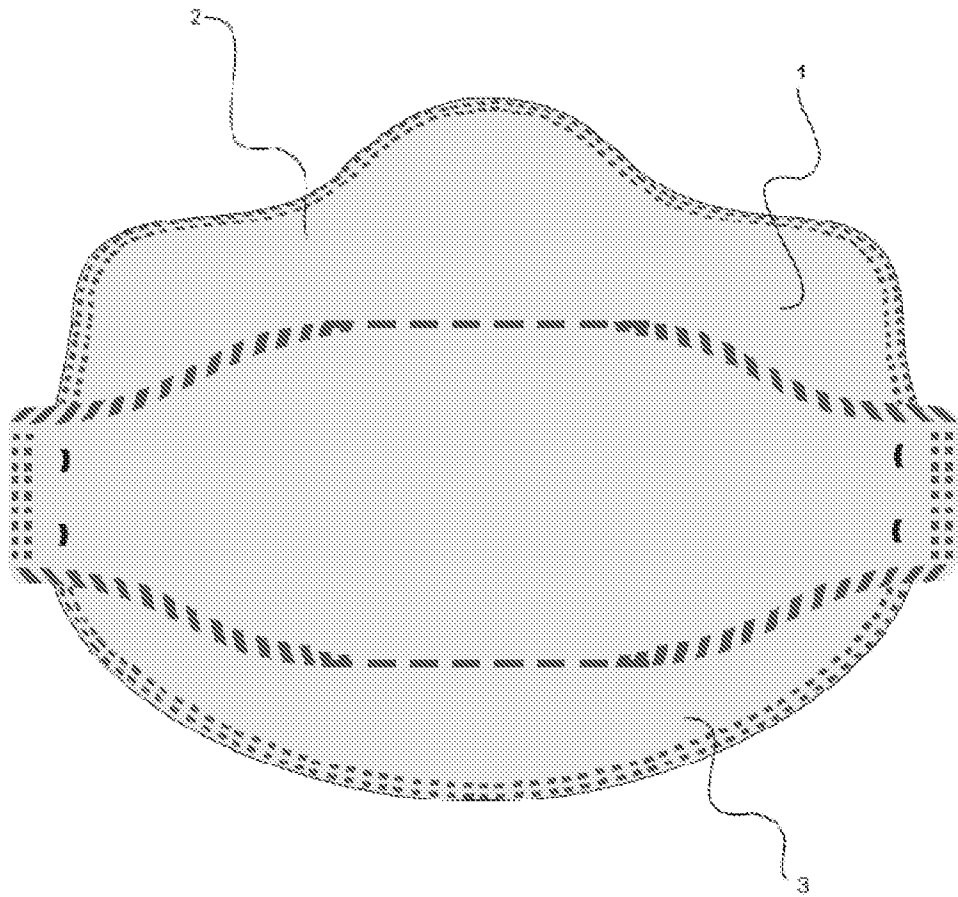
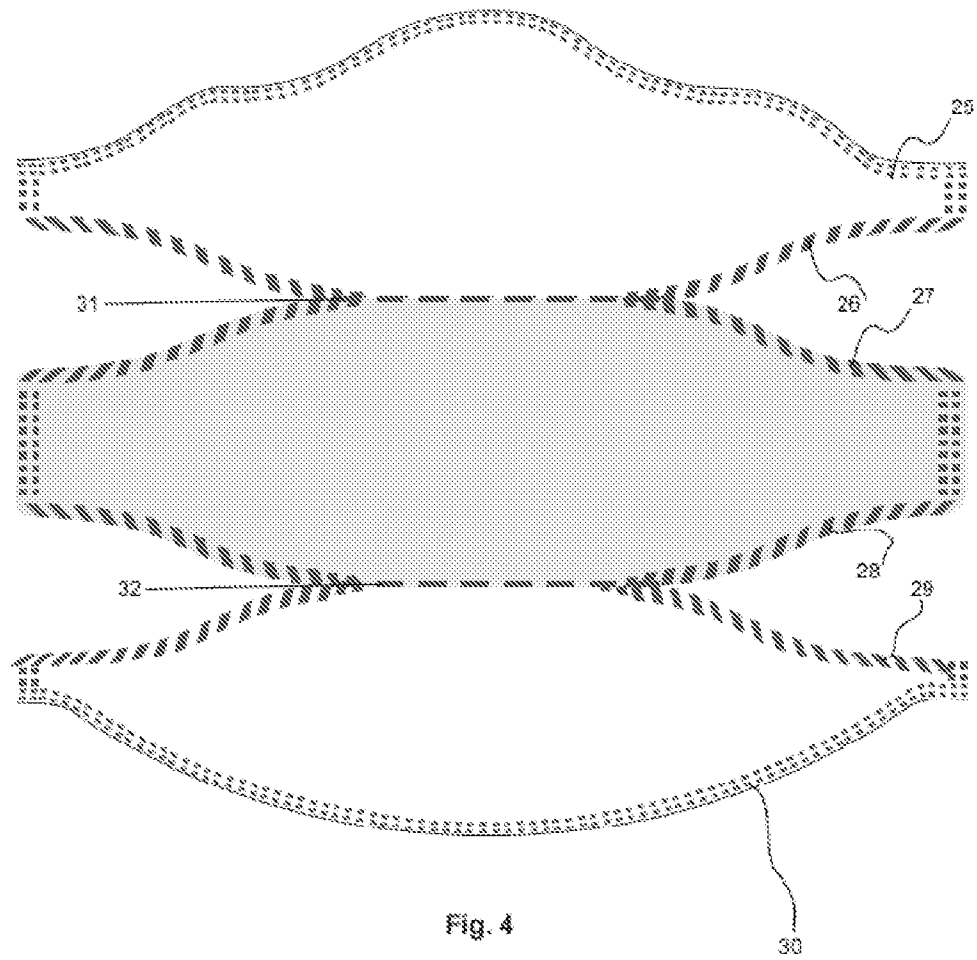


Fig. 3



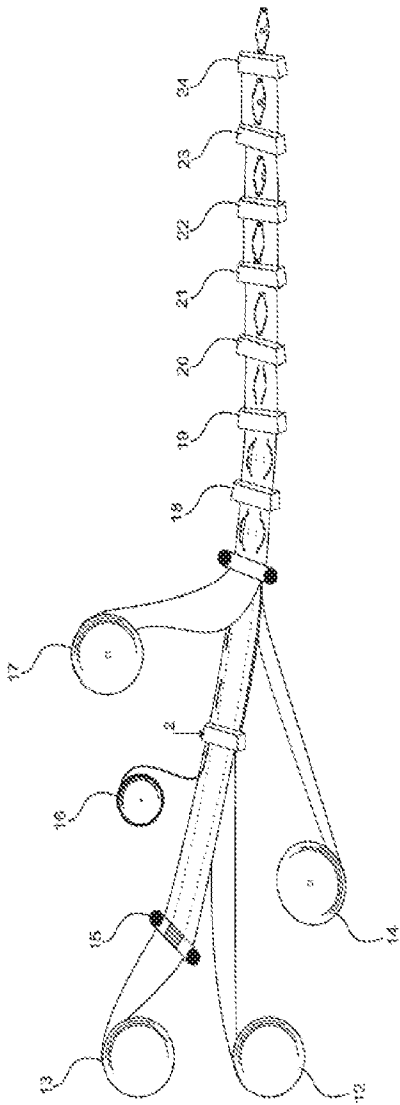
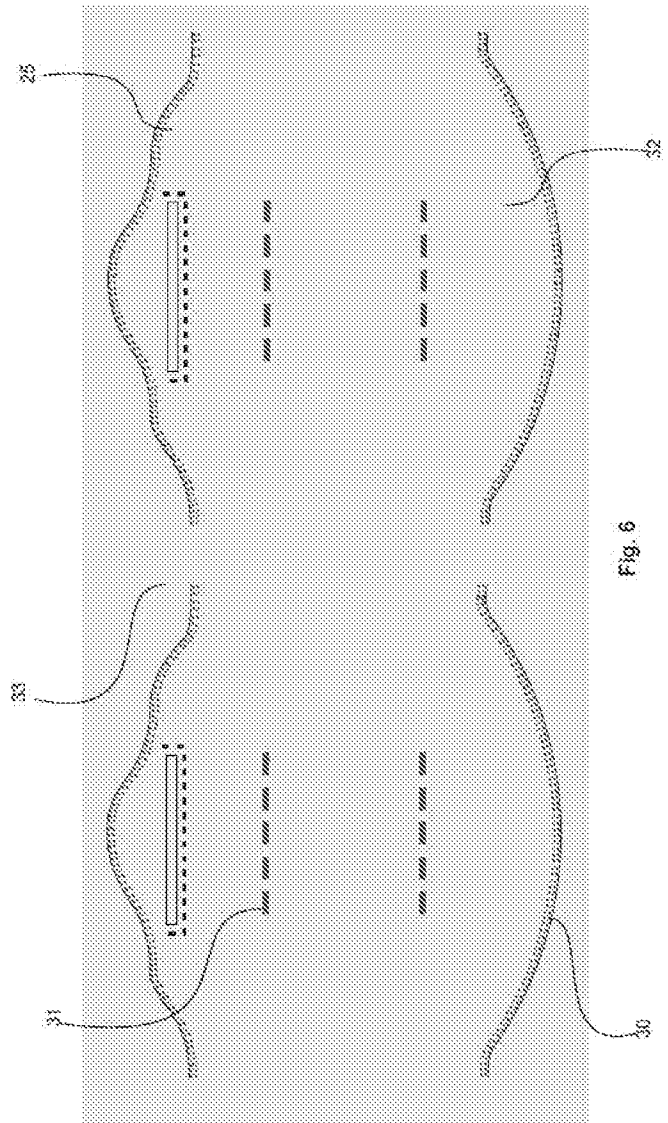
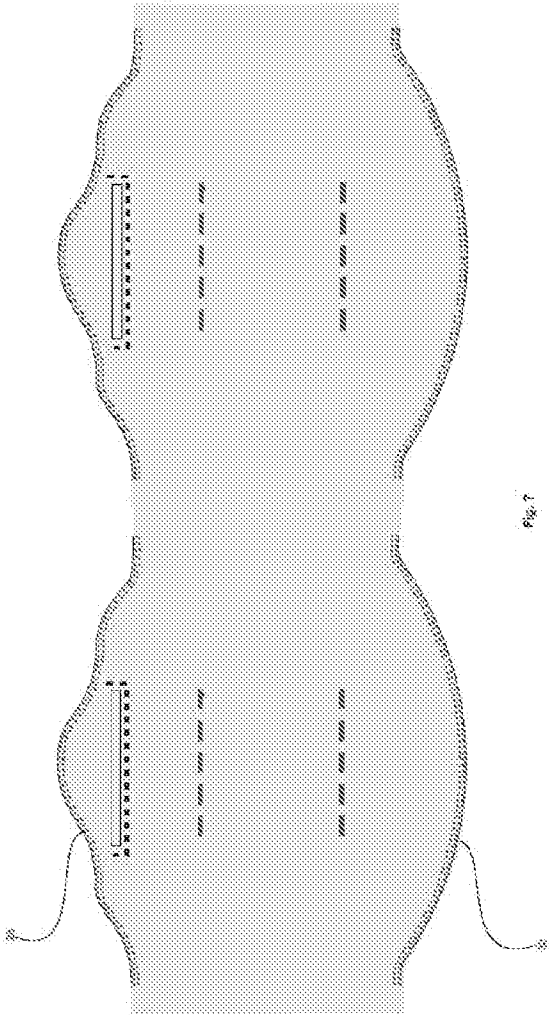
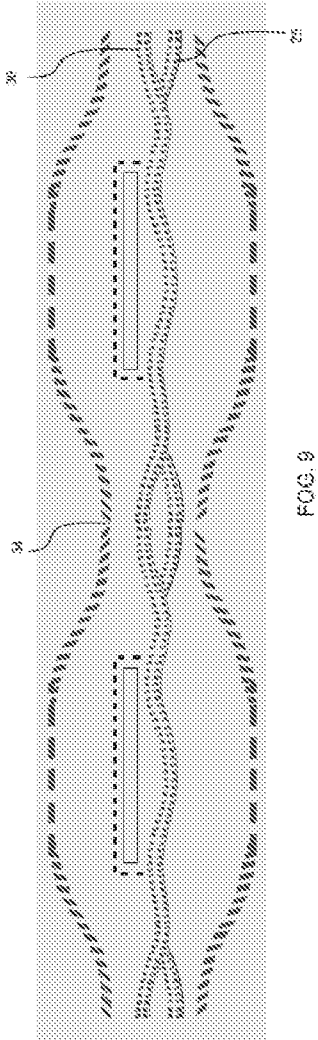
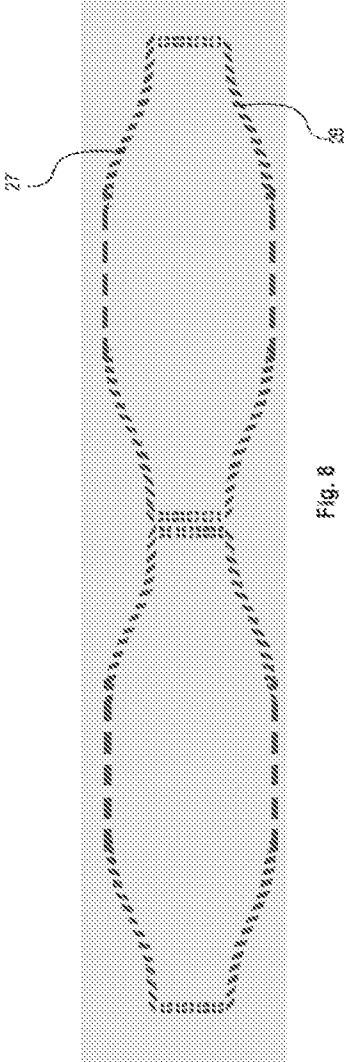


Fig. 5







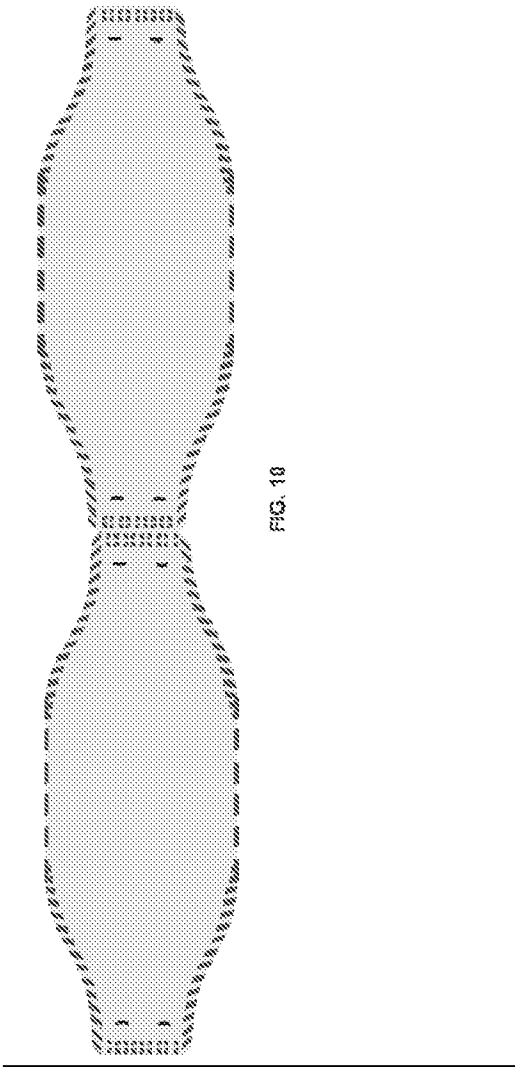


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT / IN 2017/050212

A. CLASSIFICATION OF SUBJECT MATTER IPC: A41D 13/11 (2006.01) 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) A41D 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) EPODOC, WPI, TXTnn		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9732494 A1 (MINNESOTA MINING AND MANUFACTURING COMPANY) 12 September 1997 (12.09.1997) Figures 4 and 7, page 17 line 10 - page 19 line 2, page 23 lines 8 - 13	1 - 5
☐ Further documents are listed in the continuation of Box C.		☒ See patent family annex.
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT / IN 2017/050212

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			CZ	A3	9802854	1999-01-13
			DE	T2	69703731	2001-04-19
			DK	T3	0884959	2001-01-08
			AU	A	1853097	1997-09-22
			CN	A	1213277	1999-04-07
			RU	C2	2175259	2001-10-27
			NO	A	984139	1998-09-08
			BR	A	9707926	1999-07-27
			AT	T	198128	2001-01-15
			ZA	B	9701736	1998-08-27
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			TR	T2	9801766	1998-11-23