



- (51) **International Patent Classification:**
A41D 13/11 (2006.01)
- (21) **International Application Number:**
PCT/NL2013/050382
- (22) **International Filing Date:**
24 May 2013 (24.05.2013)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (71) **Applicant:** LICA HOLDING B.V. [NL/NL]; G.A. van Nispenstraat 91, NL-6814 JA Arnhem (NL).
- (72) **Inventors:** FREIJZER, Paavo Lasse; c/o G.A. van Nispenstraat 91, NL-6814 JA Zutphen (NL). SCHILTHUIZEN, Stephanus Franciscus; c/o G.A. van Nispenstraat 91, NL-6814 JA Arnhem (NL). BOKKEN, Jacobina Gertruda Theodora Maria; c/o G.A. van Nispenstraat 91, NL-6814 JA Arnhem (NL).
- (74) **Agent:** JANSEN, C.m.; Johan de Wittlaan 7, NL-2517 JR Den Haag (NL).
- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report (Art. 21(3))

(54) **Title:** DISPOSABLE SURGICAL FACE SHIELD

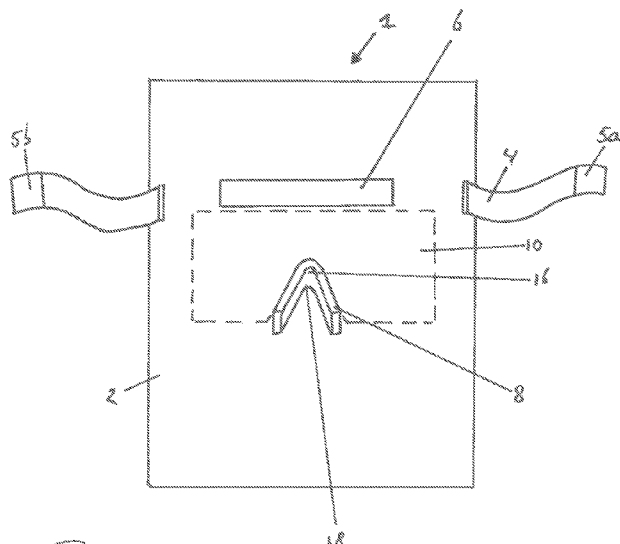


Fig. 1

(57) **Abstract:** The invention relates to a disposable surgical face shield (1) including a flexible liquid-impermeable sheet which is transparent at least in the viewing region (10), and arranged to extend over the forehead region of the wearer and the nostrils and mouth of the wearer. The shield includes a securing means (4) for securing the shield to the head of the wearer, a first spacer (6) attached to the sheet and arranged to abut against the face of the wearer above the eyes, and a second spacer (8) attached to the sheet and arranged (16, 18) to abut against the nose bridge of the wear. The second spacer is inclined such that when the shield is mounted to the head of the wearer a proximal area of the second spacer proximal to the eyes of the wearer is positioned higher than a distal area of the second spacer distal to the eyes of the wearer.



Title: Disposable surgical face shield

TECHNICAL FIELD

The present invention relates in general to a disposable medical or surgical face shield for protecting the face of a wearer from particles, fragments, droplets, and/or splashes specifically particles, fragments,
5 droplets, and/or splashes containing biological and other hazards and for providing means and methods for a clear and good view through the face shield. The present invention also relates to a method for manufacturing a disposable surgical face shield.

10 BACKGROUND

Medical professionals are exposed daily or frequently to blood, saliva, interstitial fluids, other body fluids and partly liquid and/or solid body materials that may carry infectious bacteria, viruses and materials or other blood borne or body fluid pathogens. Specifically, in the operating
15 room, it is essential that medical professionals be protected from the potentially hazardous body fluids of the patient and that the patient is protected from the potentially hazardous body fluids of the medical professionals or the patient's own hazardous body fluids that may ricochet and/or drip off the medical professionals' protective clothing. This becomes
20 especially pertinent when medical tools are used and/or procedures are performed that increase the risk of exposure to blood, body fluids, or other potential infectious materials. Secondly it is desired, due to required accuracy of the surgical work, that the medical personnel performing the operation have a clear view on and of the human tissues they're operating
25 upon when wearing any kind of facial protection.

Face shields for protecting medical professionals are known in the art. US 5,440,760 discloses a disposable face shield that comprises a

transparent plastic shield and a stretchable or elastic cord for securing the shield about the wearer's face. A crescent-shaped foam member is affixed to the transparent plastic shield at an upper-central spot. The transparent shield is of an appropriate size to protect substantially the entire facial region of an average adult. However, the shield being mounted to the forehead region of the wearer causes the shield to flex, deflect and move during use. This causes disturbances in the line of sight of the wearer, which may be a nuisance especially during complex medical procedures.

CN201718520 discloses a face shield in which the stability of the shield as been improved by addition of a sponge bracket at the location of the nose bridge of the wearer. This face shield is, however, not suitable for use during medical procedures as its line of sight is optimized for vehicle drivers and not for use during medical procedures.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a disposable surgical face shield for protecting the face of a wearer from liquid droplets and/or liquid splashes for use in professional medical settings. It is also an object to provide a face shield providing a clear view through the surgical face shield for the medical professional which is not affected by the fogging of the face shield due to the warm breath of the bearer. It is also an object of the invention to provide a simple disposable surgical face shield. It is a further object of the invention to solve the above mentioned problems. More in general it is an object of the invention to provide an improved disposable surgical face shield.

Thereeto, according to the invention is provided a disposable surgical face shield including a flexible liquid-impermeable sheet, which is transparent at least in the viewing region, and is arranged to extend over the forehead region of the wearer and the nostrils and mouth of the wearer. The face shield comprises a securing means for securing the shield to the

head of the wearer. The face shield comprises a first spacer attached to the sheet and arranged to abut against the face of the wearer above the eyes, e.g. just above the eyes, and a second spacer attached to the sheet and arranged to abut against the nose bridge and/or cheeks of the wearer. The
5 second spacer is inclined such that when the shield is mounted to the head of the wearer a proximal area of the second spacer proximal to the eyes of the wearer is positioned higher than a distal area of the second spacer distal to the eyes of the wearer.

It will be appreciated that herein nostrils refers to the openings of
10 the nose through which air can be inhaled and exhaled.

Since the second spacer is inclined such that when the shield is mounted to the head of the wearer a proximal area of the second spacer proximal to the eyes of the wearer is positioned higher than a distal area of the second spacer distal to the eyes of the wearer the field of view through
15 the sheet is optimized. The inclined second spacer allows virtually unimpeded view in all directions, with highly improved field of view in downward directions. It will be appreciated that this improved view in downward directions is especially beneficial while performing medical procedures, standing in front of, besides or above patients with the head
20 pointed slightly downwards in most cases. Herein the spacer has sufficient rigidity and/or form-stability to maintain the sheet spaced from the face of the wearer while transferring the load of the shield onto the nose bridge (and optionally the cheeks as will be discussed below) of the wearer, which improves the overall stability of the face shield in use.

25 Optionally, the sheet when disengaged from the wearer's face is substantially flat. In this case it is easier to manufacture, transport and store the disposable surgical face shields. Optionally, the sheet is a self supporting sheet or a single monolithic self supporting sheet. The first and/or second spacer can be resilient and compressible, so as to form a
30 comfortable seal between the respective spacer and the wearer's face. This

can be enhanced by providing that the surface of the respective spacer which touches the skin has a high friction coefficient and/or is sticky. It is possible that the respective spacer returns to its original form after being compressed. It is also possible that the respective spacer does not return to its original form after a finite number of compressions.

It will be appreciated that the first spacer being attached to the sheet and positioned to abut against the face of the wearer above the eyes, and the second spacer being attached to the sheet and positioned to abut against the nose bridge of the wear improve the stability of the face shield when worn.

Optionally the second spacer is mounted to the sheet already in an inclined fashion. This provides an easy way to make sure that the second spacer is inclined such that when the shield is mounted to the head of the wearer a proximal area of the second spacer proximal to the eyes of the wearer is positioned higher than a distal area of the second spacer distal to the eyes of the wearer. The second spacer may be mounted in an inclined fashion to the substantially flat sheet. This provides an easy way of manufacturing the face shield.

Optionally, the disposable surgical face shield comprises a support element including a seat arranged for supporting the second spacer.

Optionally, the disposable surgical face shield includes two support elements for supporting a first end of the second spacer and a second end of the second spacer. Preferably, the seat of the support element is angled to correspond to the inclination of the inclined second spacer. The support element is attached to the substantially flat sheet. The second spacer is also attached to the substantially flat sheet and the second spacer is preferably attached to the seat or at least contacts the seat of the support element.

Using a support element provides an improved and more easy to manufacture connection between the substantially flat sheet and the second spacer. Optionally, the support element(s) is (are) positioned to abut against

the cheeks of the wearer, when worn. Furthermore, the use of a support element may allow for the second spacer to be manufactured from a wider range of materials. In use, the support elements are additionally arranged to abut against the cheek area of the wearer's face. Therefore the support
5 element may include an addition comfort layer to improve the wearing experience of the disposable face shield.

Optionally, the second spacer comprises an inverted V-shape. The upward point of the inverted V-shape abuts against the bridge of the wearer's nose. The inverted V-shape provides good fit to the nose bridge of
10 the wearer and can have optionally a smaller thickness at this point to facilitate also a better view downward past the nose itself.

Optionally, the second spacer is arranged to assume an inclined shape after the bending of the transparent sheet to which it is attached. Optionally, the second spacer is mounted to the sheet substantially
15 perpendicularly, and the second spacer comprises an inverted V-shape. In this case, the height of the second spacer, measure perpendicular to the substantially flat sheet, and the thickness of the second spacer, measured parallel to the sheet in a cranial direction, is chosen such that the second spacer buckles when the sheet is bent to conform to the face of the wearer
20 when worn such that the second spacer is inclined such that the proximal area of the second spacer is positioned higher than a distal area of the second spacer. Preferably, height of the second spacer is chosen larger than the thickness of the second spacer. Preferably, the height is 1.5 or more times larger than the thickness, more preferably 2 or more times, such as
25 2.5 or more times or 3 or more times.

Optionally, the second spacer has lateral extent sufficient to extend over the cheeks of the wearer. This provides the advantage that the second spacer bears not only on the nose bridge of the wearer, but also on the cheeks, so as to distribute pressure more evenly over the face of the
30 wearer, increasing comfort.

Optionally, a thickness of the second spacer, measured parallel to the sheet in the cranial direction, increases from the center outwardly. Having the second spacer being thinner at the nose bridge as already mentioned, and the thickness increasing towards the cheeks improves vision. Further, this also can aid in obtaining the desired inclined orientation of the second spacer when the face shield is mounted to the head of the wearer. Optionally, a thickness of the second spacer, measured locally perpendicularly to the spacer, and parallel to the sheet, increases from the center outwardly.

10 Optionally, a height of the second wall, measured perpendicular to the sheet decreases from the center outwardly. This can improve stability of the shield when worn. This can also aid in obtaining the desired inclined orientation of the second spacer when the face shield is mounted to the head of the wearer. This can also compensate for the effect of the second spacer pivoting away from the face when the second wall buckles when the sheet is bent.

 Optionally, the disposable surgical face mask includes a chin support. The chin support forms a spacer mounted to the face shield and positioned to abut against the chin of the user, when worn. This provides further stabilization of the face mask with respect to the face of the user. The chin support can e.g. be a foam block, or a lip-like spacer (e.g. angled downwardly towards the throat of the user, when worn).

 In an embodiment the second spacer is impermeable to vapor and/or gases. As the second spacer is impermeable to vapors and gases, the second spacer forms a vapor barrier and prevents vapor from the wearer's breath exhaled from the mouth and/or nostrils from entering and fogging the viewing region. The impermeability to vapor can e.g. be achieved by coating a surface of the second spacer, e.g. the surface directed towards the mouth and nostrils, with a vapor impermeable coating or a vapor impermeable sticky, adhesive coating of silicone or other adhesive natural or

polymer material, which can seal the contact surface between the second spacer and the skin of the wearer. Instead of a coating also a cladding can be used. Alternatively, or additionally the second spacer can be made of a sandwich material having at least one layer being impermeable to vapor and gases. Alternatively, the second spacer can be permeable to gases, such as air, but has the ability to absorb warmer vapor and moisture parts which primarily contribute to the so-called fogging effect. This can be achieved via use of woven, knitted or non-woven textile materials, foams etc, in the second spacer.

10 In an embodiment, the first spacer comprises –one or a plurality of ventilation apertures for ventilating the viewing region. These ventilation apertures also aid in preventing fogging of the viewing region in the event of moisture build-up in the viewing region, e.g. in case of perspiration. Therefore the disposable surgical face shield can be kept fog and moisture free in the viewing region, yet remains comfortable for the wearer owing to the ventilation apertures in the upper wall. Optionally, the ventilation apertures are inherent to a material used to construct the first spacer. An example of a venting material is a spacer fabric or a with textile coated open cell foam material.

20 Optionally, the second spacer comprises, or is made from, a closed cell foam. The closed cell foam provides the vapor barrier. Optionally, the first spacer comprises, or is made from, an open cell foam. The open cell foam provides also a barrier against liquid droplets and/or liquid splashes, while being comfortable to wear.

25 In an embodiment the first and second spacer are connected by side spacers to form a circumferential spacer arranged to enclose the viewing region including the eyes and excluding the nostrils and the mouth. The circumferential spacer encloses and provides protection to the viewing region, which includes the eyes and facial regions directly adjacent to the eyes. The viewing region is hence well protected from liquid droplets and/or

30

liquid splashes that fall behind the shield or land on the head of the wearer and drip behind the shield.

Optionally, the circumferential spacer is contoured and varies in thickness and/or height. This provides a better fit for wearers with and
5 without eyeglasses, or wearers with larger or smaller facial features.

Optionally, the first, second and/or side spacers are provided with a textile layer at the surface opposite the sheet, i.e. the surface abutting against the face, when worn. This can increase comfort of wearing and can absorb perspiration.

10 Optionally, the circumferential spacer has faceted or rounded corners with large radii at the left and right end of the contoured spacer, which can be used to incline the right and left sides of the transparent shield in permanent or semi-permanent way to the spacer. This provides a better protection of the left and right side of the face and eye and ear areas
15 of the user and a better fit to the contour of the head of the wearer.

The securing means is arranged to tighten and hold the disposable surgical face shield in front of the wearer's face. Optionally the securing means is one of e.g. an elastic strap, an adjustable elastic strap, a hook and loop (Velcro) strap, ear loops, head harness, and adhesive such as
20 a silicone adhesive. The securing means can be attached to the sheet such that in use the securing means causes the flexible liquid-impermeable to bend around the wearer's face. The shape induced by the securing means is ideal for protecting the wearer. The securing means can be attached to the sheet e.g. by at least one of a weld, an ultrasonic bond, a slot, a rivet, and an
25 adhesive. Optionally, the securing means is attached to the first spacer e.g. by at least one of a weld, an ultrasonic bond, a slot, a rivet, and an adhesive. Optionally, the securing means is attached to an inside surface of the sheet, e.g. the same side as the first spacer. Alternatively, the securing means is attached to an outside surface of the sheet.

The sheet is transparent at least in the viewing region such that in use the wearer's vision is not inhibited. Optionally, the sheet outside the viewing region is opaque or partially opaque. The sheet may be (partially) opaque outside the viewing region due to the inherent properties of a material of the sheet or due to a coating or laminated layer. Optionally, the sheet outside the viewing region comprises a non-reflective material for preventing unwanted reflections of light during a medical procedure. The sheet can optionally have an integrally formed cavity for the nose. Such a nose cavity can e.g. be provided in the sheet by means of thermoforming or vacuum forming. Such nose cavity provides a higher stiffness of the sheet and allows reduction of the thickness of the first and/or second spacer. This nose cavity can partly or wholly surround the nose. Another advantage is that such nose cavity results in a smaller distance between the eyes and the transparent part of the sheet which enhances the sight and vision of the wearer. Instead of a nose cavity, it is also possible that the sheet is preformed such that when worn the viewing region is closer and more closer and parallel to vertical center line to the eyes like glasses or spectacles than the non-viewing region is to the remainder of the face. The viewing region can be parallel to a vertical center line of the shield. The viewing region can extend at a distance from the eyes that corresponds to a normal back vertex distance (BVD) for glasses, e.g. 10-15 mm, preferably 12-13 mm, from the cornea, to provide improved vision through the viewing region. It will be appreciated that also in these cases the second spacer can be inclined such that when the shield is mounted to the head of the wearer a proximal area of the second spacer is positioned higher than a distal area of the second spacer. It will be appreciated that hence the second spacer, and/or the first spacer, can be at least partially formed by one or more preformed protrusions of the sheet. Such protrusions can e.g. be clad with a material, such as a fabric or foam, enhancing wearing comfort or forming a vapor barrier.

The first spacer can be arranged to abut against the wearer's face above the eyes and preferably just above the eye brows of the wearer. The side spacers can be arranged to abut against the wearer's face to the right and left of the wearer's right and left eyes respectively, and preferably
5 against the wearer's temple regions, behind the most outward extreme of the eye socket. The second spacer wall is arranged to abut against the wearer's face above the nostrils and/or under the eyes. Optionally, the second spacer abuts against the face under the eyes in the cheek bone region.

10 Optionally, the first spacer includes an absorption strip arranged to abut against the wearer's face. The absorption strip absorbs sweat and provides a generally more comfortable wearing experience.

 Optionally, the second spacer comprises an inner wall adjacent to the viewing region. The inner wall of the second spacer includes an anti-
15 glare strip. This strip reduces the amount of light reflected into the wearer's eyes. Optionally, the viewing region includes an anti-glare strip. Preferably the anti-glare strip is located just above the eyes and shields the wearer's eyes from harsh overhead lighting. Optionally, the side spacers comprise an inner wall adjacent to the viewing region including anti-glare strips.

20 In order to provide optimal protection for the wearer the sheet is arranged to extend over the nostrils and mouth of the wearer, and optionally to extend over the chin. Additionally, the sheet is arranged to extend beyond the first spacer such that it extends over the forehead region of the wearer, and optionally to top of the forehead region of the wearer.

25 Optionally, a protective cloth is attached to a top edge of the sheet and is arranged to extend over the top of the wearer's head. Optionally, a protective cloth is attached to a bottom edge of the sheet and is arranged to extend over the chin and the neck region of the wearer. Optionally, the protective cloth is made from a venting material and/or is impermeable to
30 liquid, like a coated or chemically treated textile fabric. Optionally, the

protective cloth extends over and around the wearer's entire head. It is also possible that the face shield is provided with an protective wall extending below the chin of the user, when worn. The protective wall can be made from a venting material and/or is impermeable to liquid. The protective wall
5 can be made of foam. Optionally the protective wall is mounted to the sheet slanting downwardly towards the throat of the user, when worn.

Optionally, a protective cloth is attached to the skin side or sheet side of second spacer, and is arranged to extend over the mouth and the neck region of the wearer.

10 Optionally, the sheet is arranged to extend over the temple regions of the wearer. This embodiment provides additional protection for liquid droplets and liquid splashes directed at the sides of the wearer's head.

Optionally, the spacers, e.g. the first spacer, the second spacer and/or the side spacers, are arranged to be impervious to droplets and/or
15 splashes of liquid. It should be noted that in this case the ventilation apertures can also be impervious to liquid droplets and/or liquid splashes. Thereto the ventilation apertures can e.g. be covered by a covering material, such as a woven or non-woven or circular or flat knitted textile fabrics that allows air to pass but catches and absorbs, holds or deflects liquid droplets
20 and/or liquid splashes. It is also possible that the ventilation apertures are made from a first material or are inherent to a first material having sufficient hydrophobic properties to prevent liquid droplets from passing through the material. The hydrophobic surface characteristics may be inherent to the material or be provided by a coating or plasma treatment.
25 The first material may be used in combination with a second material, also including ventilation apertures, having hydrophilic properties to absorb, catch and/or hold liquid droplets that pass through the first material. It is also possible that the hydrophobic and hydrophilic properties are achieved by applying finishes and/or coatings to the first material and/or second
30 material. The desired properties may also be achieved by various solutions

including but not limited to: closely knit or woven fabrics with hydrophobic and/or hydrophilic finishes or coatings; monolithic films which provide ventilation and form a barrier against liquid droplets; printed structures with higher and lower hydrophobic surface characteristics; nanoneedles in a
5 coating; Gore-Tex like materials; PU coatings; and 3D textiles. It is also possible that the ventilation apertures have a geometry, such as a labyrinth, that allows passage of ventilation gases, but prevents passage of droplets.

Optionally, the spacers, e.g. the first, second and/or side spacers, are arranged to catch droplets and/or splashes of liquid. Optionally, the
10 spacers, e.g. the first, second and/or side spacers, are arranged to absorb droplets and/or splashes of liquid. Optionally, the spacers, e.g. the first, second and/or side spacers, are arranged to hold droplets and/or splashes of liquid. Due to the high absorption ability and/or hydrophilic properties of the spacers, liquid droplets and splashes of liquid can be caught, held,
15 and/or absorbed by the spacers or a portion thereof. Therefore liquid droplets and liquid splashes can be prevented from entering the viewing region.

Optionally, the sheet includes, e.g. is made from, a liquid repellent material at least in the viewing region. Optionally, the sheet
20 includes, e.g. is made from, a hydrophobic material at least in the viewing region. Optionally, the sheet includes, e.g. is made from, a liquid absorbent material at least outside the viewing region. Optionally, the sheet includes, e.g. is made from, a hydrophilic material at least outside the viewing region. Optionally, the sheet has a liquid repellent coating at least in the viewing
25 region. Optionally, the sheet has a hydrophobic coating at least in the viewing region. Optionally, the sheet has a liquid absorbent coating at least outside the viewing region. Optionally, the sheet has a hydrophilic coating at least outside the viewing region. Such a coating or material helps keep the viewing region clear of any liquid droplets and splashes that could
30 hinder the wearer's vision. Liquid droplets and splashes that land outside

the viewing region can be caught, held, and/or absorbed by the coating or material. The sheet could e.g. be made from a liquid repelling material and have a hydrophilic coating outside the viewing region, or be made from a hydrophilic material and have a liquid repelling coating inside the viewing region. Optionally the sheet could e.g. be made from a liquid repelling material and have a hydrophobic coating or is made from an a-polar polymer material inside and outside the viewing region which allows droplets to quickly roll down the sheet to an element capable of absorbing and capturing these droplets.

10 Liquid droplets or liquid splashes that land on the sheet could slide off the sheet and drip onto the patient being treated. It is possible that the liquid carries a pathogen. When the contaminated liquid drips off the face shield and onto the work area, such as the patient, or even worse into the patient via an incision, wound, or opening, the patient could be come
15 infected. An absorbent strip could catch, absorb, and/or hold the potentially hazardous liquid. Such strips are most effectively placed on the edges of the face shield and below the viewing area. It is conceivable that in certain medical environments during certain medical procedures a plurality of strips may be necessary to catch, absorb and/or hold all liquid that comes in
20 contact with the face shield. Even if the patient is well protected during the procedure, contaminated liquid that drips off the face shield could come in contact with medical instruments or the medical environment. It is generally good practice that the medical environment is kept as clean as possible. Optionally, as indicated already above, the sheet therefore includes
25 a strip of a super absorbent material arranged to catch, absorb and/or hold droplets of liquid that land directly on the strip or slide from the sheet into the strip. Optionally, the sheet includes a plurality of strips of a super absorbent material. Optionally, the strip of super absorbent material is attached to an edge of the sheet. Optionally, a strip of super absorbent
30 material extends across a bottom of the sheet substantially parallel to a

bottom edge of the sheet. Optionally, a strip of super absorbent material extends across a top of the sheet substantially parallel to a top edge of the sheet. Optionally, the super absorbent material is a super absorbent polymer. Optionally, the super absorbent material is a woven textile or
5 knitted textile material comprising micro polyester fiber or super micro polyester fibers capable of capturing a number of droplets.

Optionally, a protective cloth is attached to the skin side or sheet side of second spacer or the lower end of the transparent sheet and extends over the mouth and the neck region of the wearer and is able to catch and
10 absorb liquid droplets or liquid splashes, preventing them to fall back to patient or surgery area.

It may be desirable that potentially hazardous liquids are not only caught, absorbed, and/or held, but that the liquid is also rendered harmless by an antimicrobial substance included in the shield.

15 Optionally, the sheet includes an antimicrobial substance arranged to interact and inhibit the growth of one of a bacteria, viruses, algae, and fungi (microbes). The substance may be inherent to the material of the sheet, or added to the sheet e.g. in the form of a coating or a laminated layer. Optionally, the strip includes an antimicrobial substance
20 arranged to interact with and/or inhibit the growth of one of a bacteria, viruses, algae, and fungi (microbes). Optionally, the antimicrobial substance is a metal ion such as a silver ion. Optionally, the antimicrobial substance has a natural basis from plants and herbs.

Optionally, the spacers are attached to the screen by at least one
25 of a weld, an ultrasonic bond, a rivet, and an adhesive.

According to the invention is also provided a method for manufacturing a disposable surgical face shield comprising: providing a flexible liquid-impermeable sheet being dimensioned to extend over substantially the entire facial region of a wearer, wherein the sheet is
30 transparent at least in a viewing region; providing a securing means;

providing a first spacer and a second spacer; attaching the first spacer to the sheet such that it is positioned to abut against the wearer's face above the eyes; attaching the second spacer to the sheet such that it is positioned to abut against the wearer's nose bridge such that when the shield is mounted
5 to the head of the wearer the second spacer is inclined such that a proximal area of the second spacer proximal to the eyes of the wearer is positioned higher than a distal area of the second spacer distal to the eyes of the wearer

Optionally, the step of attaching the second spacer to the sheet
10 further includes the step of attaching a support element to the substantially flat sheet with flat sides on the contact surfaces with the transparent sheet. Preferably, the step of attaching a support element to the substantially flat sheet is performed prior to the step of attaching the second spacer or this is pre-assembled in production. In this way an improved connection between
15 the substantially flat sheet and the second spacer is achieved due to the flat glueing or connection surfaces.

According to another aspect of the invention is provided a disposable surgical face shield including a liquid-impermeable screen arranged to extend over at least a viewing region including the wearer's
20 eyes and a securing means. The screen includes a display. The screen is provided with electrical contacts for interfacing to and controlling the display with a control unit. Therefore the surgical face shield including the display can be discarded, but the control unit controlling the display can be reused.

25 Alternatively, a disposable surgical face shield including a liquid-impermeable screen arranged to extend over at least a viewing region including the wearer's eyes and a securing means is used in an assembly further including a display and a control unit wherein the display and control unit are releasable connected to the face shield. It is for instance
30 possible that the display is adhered to the screen, e.g. by means of a re-

adherable adhesive (multi-use), static adhesive, auto-collant, or windscreen-sticker effect. Therefore the surgical face shield can be discarded, but the display and control unit controlling the display can be reused.

Both with respect to the disposable face shield including the display and the assembly including the disposable face shield and the display the following applies.

Optionally, the display is included on an inside of the face shield to prevent damage and/or contamination to the display.

Optionally, the screen is arranged to extend over the forehead region of the wearer, and the screen is arranged to extend over the nostrils and mouth of the wearer. Thus the screen protects the wearer's entire face.

Optionally, the screen includes a display inside the viewing region. Optionally, the screen includes a display outside the viewing region. Optionally, the screen includes a display inside and outside the viewing region. Optionally, the display is transparent or semi-transparent. This is especially advantageous when the display is inside the viewing region.

Optionally, the screen includes an organic light-emitting diode (OLED) display arranged for displaying information relating to the current surgical procedure. Optionally, the OLED display is one of a passive matrix OLED display and an active matrix OLED display.

In a medical procedure environment information must be communicated in a quick and efficient manner. Information regarding the current medical procedure or patient being treated must always be readily available to the medical professionals performing the procedure. If such information is displayed on the screen inside the viewing region, the wearer can make use of the screen as a head-up display. In this case real-time medical imaging, such as from a camera, or previously acquired medical imaging, such as magnetic resonance imaging (MRI), computed tomography (CT) and X-ray, could be displayed in the viewing region and e.g. appear to the wearer as an overlay on the patient. In other words, while viewing the

patient the wearer of the display included in the screen could see the medical imaging “superimposed” on the patient. On the other hand, if such information was displayed outside the viewing region, other medical professional working along side the wearer could utilize the display included
5 in the screen as an information monitor. It will be appreciated that (a processing unit of) the display may thereto be arranged to retrieve such information from a memory or database.

Optionally, the disposable surgical face shield includes a wired or wireless receiver arranged to receive content to be displayed on the display.
10 The receiver is arranged to interface with the display via the control unit and electrical contacts of the screen. Optionally, the receiver is arranged to interface directly with the display via an interface. The wireless receiver may make use of WiFi, Bluetooth, ZigBee, GSM, UMTS, UWB or the like.

Optionally, the disposable surgical face shield includes a sensor
15 and/or camera arranged to transmit signals to the control unit. The control unit further comprises a processing unit arranged to determine what part of the patient is being viewed by the wearer from the transmitted signals from the camera and/or sensor. The camera and/or sensor are releasable connected to the face shield to facilitate reuse.

Optionally, the processing unit is arranged to interact with a
20 medical image database to determine what portion of a medical image corresponds to the portion of the patient being viewed by the wearer. The control unit may then cause the display to display a medical image corresponding to (overlying with) the portion of the patient being viewed by
25 the wearer. Optionally, the control unit and/or the receiver includes a network interface.

Optionally, the content to be displayed on the display is controllable via a web application or mobile telephone application (smart phone app).

Optionally, the display displays information related to vitals, such as heart rate, ECG, oxygen saturation (SpO₂), carbon dioxide saturation (SpCO₂), blood pressure (systolic/diastolic), respiratory rate, respiratory stroke volume, and temperature, of the patient being treated. It will be appreciated that the processing unit may thereto be arranged to retrieve such information from an on-line measurement system measuring the information to be displayed.

Optionally, the display displays camera images from a camera active in the medical treatment environment, such as an endoscopic camera. Optionally, the display included in the screen displays content related to the current medical procedure, such as instruction steps. Optionally, the display included in the screen displays MRI, CT, and/or X-ray images previously acquired or acquired in real-time. Optionally, the display displays entertainment content, such as movies, informational content related to the current medical procedure, and/or advertisements for the patient being treated.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further elucidated by means of non-limiting examples referring to the drawings, in which

Fig. 1 is a schematic representation of a front view of a disposable surgical face shield;

Fig. 2a is a schematic representation of a disposable surgical face shield;

Fig. 2b is a schematic representation of a side view of a disposable surgical face shield;

Fig. 2c is a schematic representation of a disposable surgical face shield;

Fig. 2d is a schematic representation of a side view of a disposable surgical face shield;

Fig. 3a is a schematic representation of a disposable surgical face shield;

Fig. 3b is a schematic representation of a side view of a disposable surgical face shield;

5 Fig. 4 is a perspective top view of a disposable surgical face shield in use;

Fig. 5 is a schematic representation of a rear view of a disposable surgical face shield, wherein the screen includes a display inside the viewing region;

10 Fig. 6 is a schematic representation of a front view of a disposable surgical face shield, wherein the screen includes a display outside the viewing region.

DETAILED DESCRIPTION

15 Figure 1 depicts a disposable surgical face shield 1 disengaged from a wearer's face. The disposable surgical face shield 1 includes a flexible liquid-impermeable sheet 2 for protecting a wearer from particles, fragments, droplets, and/or splashes. The disposable surgical face shield 1 further includes a securing means 4. The disposable face shield 1 further
20 includes a first spacer 6 and a second spacer 8. The first spacer 6 is positioned so as to be above the eyes of the wearer when the face shield 1 is worn by the wearer. The second spacer 8 is positioned so as to abut against the nose bride of the wearer when the face shield 1 is worn by the wearer. Generally, the first spacer 6 and the second spacer 8 are positioned outside
25 a viewing region 10 of the face shield 1. In this embodiment the securing means 4 is attached to the same side of the screen 2 as the circumferential spacer and includes a hook 5a and loop 5b portion for securing the face shield.

In this example, when the disposable surgical face shield 1 is
30 disengaged from the wearer's face, the shield 1 and sheet 2 are substantially

flat. Additionally, in this example sheet 2 is a monolithic self supporting sheet of transparent material, such as plastic. The first spacer 6 and second spacer 8 each have a thickness appropriate for establishing a spacing between the sheet 2 and the wearer's face, preferably such that the wearer's nose does not come in contact with the sheet 2. It is conceivable that different spacer thicknesses need to be provided for wearers with and without eyeglasses or magnifying glasses, or wearers with larger or smaller facial features.

It will be appreciated that in this example the second spacer 8 has an inverted V-shape. The point of the V-shape abuts against the nose bridge of the wearer. In this example, a thickness, t , of the second spacer, measured parallel to the sheet 2 in the cranial direction increases when going outwardly from the center. It is also possible that a height, h , of the second spacer, when going outwardly from the center decreases. This may enhance the wearing comfort.

Figures 2a and 2b show a second embodiment of a disposable surgical face shield 1. The face shield 1 shown in Figures 2a and 2b is highly similar to the face shield 1 shown in Figure 1. The differences are as follows. In Figure 2a can be seen that the first spacer 6 is provided with cutouts 12. Further, in Figure 2a it can be seen that the second spacer 8 is provided with extensions 14 arranged to extend over the cheeks of the wearer when the face shield 1 is worn by the wearer. The extensions 14 can extend beyond the inverted V-shaped section of the second spacer 8.

As can clearly be seen in Figure 2b, the second spacer is inclined such that a proximal area 16 of the second spacer proximal to the eyes of the wearer is positioned higher in cranial direction than a distal area 18 of the second spacer distal to the eyes of the wearer.

In the example of Figure 2a the first spacer 6 is provided with angled ends 13. The angled ends 13 slope away from the sheet 2 (in flat situation) at an acute angle. The angled ends allow the sheet 2 to smoothly

bend around the first spacer 6 when being worn by the wearer. This can also improve positioning of the sheet 2 along the temple regions of the wearer.

Figures 2c and 2d show a further example of the second embodiment of a disposable surgical face shield 1. The disposable face shield further comprises support elements 11 including a seat 13 arranged for supporting the second spacer. In Figure 2c, a portion of the second spacer 8 has been cut away in order to better show the seat 13 of the support element 11. In this example, the seat 13 of the support element is angled to correspond to the inclination of the inclined second spacer 8. Furthermore, the support element is attached to the substantially flat sheet by an adhesive. In this example, the second spacer 8 is attached to both the substantially flat sheet 2 and the seat 13 of the support element 11 by an adhesive. A support element is provided at both a first end 8A and a second end 8B of the second spacer (see Figure 2a). In the example depicted in Figures 2c and 2d, the support element 11 is manufactured using a thermoforming technique, via applying heat and pressure to a material.. Additionally, or before the thermoforming, a comfort layer 7, such as a textile, has been attached to the support element 11 to improve the wearing comfort of the disposable face shield 1. In this example the support element 11 is suitably positioned to abut against the cheeks of the wearer, so as to provide a stable and comfortable positioning of the face shield against the face of the wearer. The support element may also be manufacture from other materials such as foam or expanded foams including EPS, EPP, and EPE. Additionally, the use of a support element 11 may allow for the second spacer to be manufactured from a wider range of materials such as foam having a textile liner, non-woven material, or thermoformed materials.

Figures 3a and 3b show a third embodiment of a disposable surgical face shield 1. The face shield 1 shown in Figures 3a and 3b is highly similar to the face shield 1 shown in Figures 2a and 2b. The difference is as follows. In Figure 2b it can be seen that the second spacer 8 is positioned

substantially perpendicular to the sheet 2 when the sheet is substantially flat when not engaging the head of the wearer. Also in this embodiment the second spacer 8 comprises an inverted V-shaped section. In this case, the height, h , of the second spacer 8, measure perpendicular to the substantially flat sheet 2, and the thickness, t , of the second spacer, measured parallel to the sheet in a cranial direction, are chosen such that the second spacer 8 buckles when the sheet 2 is bent to conform to the face of the wearer when worn. This buckling, in combination with the inverted V-shape, causes the second spacer to incline when the shield 1 is worn. The inclination of the second spacer 8 in this case is also such that the proximal area 16 of the second spacer 8 is positioned higher in cranial direction than a distal area 18 of the second spacer 8. In order to provide efficient buckling of the second spacer 8, in this example the height, h , of the second spacer is chosen larger than the thickness, t , of the second spacer 8. In embodiments, the height can be 1.5 or more times larger than the thickness, more preferably 2 or more times, such as 2.5 or more times or 3 or more times. In this example the second spacer 8 is pre-shaped prior to mounting the second spacer to the sheet 2. This pre-shaping can e.g. be done by shaping the foam material with or without textile covering under high temperature and/or high pressure as is known in the art. The pre-shaped second spacer 8 is glued to the sheet 2 in this example.

It is noted that in Fig. 3a it can be seen that the second spacer 8 is provided with a vapor impervious material layer 9. This impervious layer 9 is mounted to the surface of the second spacer 8 that is directed towards the mouth and nostrils when the shield 1 is worn. It will be appreciated that this layer 9 prevents exhaled breath from entering the viewing region 10 and fogging the sheet 2. The layer 9 can also be used in the embodiments shown in the other figures.

Reference is now made to figure 4. The sheet 2 extends over substantially the entire facial region of the wearer 20. The first spacer 6 is

positioned above the viewing region 10. The viewing region 10 includes the eyes 22 and excludes the nostrils 24 and the mouth 26 of the wearer 20. Since sheet 2 is formed as a single sheet of transparent material, sheet 2 is transparent both inside and outside viewing region 10.

5 The second spacer 8 abuts against the wearer's face above the nostrils 24 and under the eyes 22 of the wearer. The first spacer 6 abuts against the wearer's face above the eyes 22. In this example, the disposable surgical face shield 1 further includes side spacers 28 which abuts against the wearer's face to the right of the right eye, and to the left of the left eye,
10 respectively. In Figure 4, the first spacer 6 and second spacer 8 together with the side spacers 28 form a circumferential spacer 30 arranged to abut against the face along its entire circumference. This provides the advantage of separating the entire viewing region 10 from the surroundings, and protecting the eyes from foreign objects.

15 The sheet 2 extends beyond the first spacer 6 such that it extends over the forehead region of the wearer. The sheet 2 also extends beyond the second spacer 8 such that it extends over the nostrils 20 and mouth 24 of the wearer. In this embodiment the sheet extends beyond the side spacers 28 over the left and right temple regions of the wearer, respectively.

20 Furthermore, in this example, the second spacer 8 is impermeable to vapor and forms a vapor barrier between on the one hand the nostrils 24 and mouth 26 and on the other hand the viewing region 10. The first spacer 6 comprises a plurality of ventilation apertures 17 for providing ventilation to the viewing region 10. The ventilation apertures 17 are covered by a
25 covering 19. The covering 19 is permeable to air, but forms a barrier against liquid droplets. In Figure 4 a portion of covering 19 has been removed for illustrative purposes only in order to expose apertures 17. It is possible that the first spacer 8 does not comprise ventilation apertures and that the side spacers 28 comprise ventilation apertures.

It will be appreciated that, similarly, the second spacer 8 in the examples of Figures 1 - 3b can also be impermeable to vapor. It is for instance possible that the second spacer 8 includes, or is formed from, a closed cell foam. It will be appreciated that, similarly, also the first spacer in
5 the examples of Figures 1 - 3b can include ventilation openings. For instance, the cutouts 12 in the example of Figure 2a can form ventilation openings. If desired also these ventilation cutouts can be covered by a covering to form a barrier against liquid droplets. It is also possible that the first spacer 6 is formed of an open cell foam so as to form the ventilation
10 openings. The open cell foam can also provide impermeability to droplets of liquid.

In the example of Figure 3, the shield 1 also includes a strip 15 of super absorbent material arranged to catch, absorb, and/or hold liquid droplets and/or liquid splashes that land directly on the strip or slide from
15 the sheet into the strip. In this embodiment the strip 15 includes a super absorbent polymer and extends across the bottom of edge of sheet 2. It will be appreciated that this strip 15 can also be included in the embodiments of the face shield 1 described in view of Figures 1 - 3b.

Alternatively, or additionally, the sheet may hold liquid droplets
20 outside the viewing region 10. This provides the advantage that the droplets are preventing from running from the sheet 2 e.g. onto a patient. Also the sheet 2 may be liquid repellent inside the viewing region 10. This provides the advantage that droplets hitting the sheet 2 will automatically disappear (e.g. slide) from the viewing region. The liquid holding/repellent properties
25 may be inherent to the sheet material and/or be obtained by means of a suitable coating to the sheet 2.

Figures 5 and 6 depict two alternative embodiments of disposable surgical face shield 1, comprising a screen including a display 50. All of the technical features described with respect to figures 1-4 can be included in

the disposable surgical face shields 1 of figures 5 and 6. The same reference numbers have been used to designate these corresponding features.

Electrical contacts 38 for interfacing the display 50 with a control unit 40 are shown in figures 5 and 6. The control unit 40 is communicatively
5 connected to a receiver 42. Instead of, or in addition to, the receiver 42, the control unit 40 can also be communicatively connected to a data storage unit 44. The electrical contacts 38 are connected to the control unit 40 by a first cable 39, and the control unit 40 is connected to the receiver 42 by a second cable 41, and to the data storage unit 44 by a third cable 43. It is
10 conceivable that cables 39, 41 and/or 43 are replaced by wireless interfaces. In the alternative embodiments, the display 50 is attached by re-adherable adhesive on an inside of the face shield 1, e.g. the same side as the spacers. This prevents damage and/or contamination of the display 50. Furthermore in the display 50 can be an active matrix OLED display.

15 Figure 5 shows the disposable surgical face shield 1, wherein a display 50 is included inside the viewing region 10. Figure 5 is a rear view, or wearer view, of the shield 1. In this case it is convenient that the display 50 acts as a head-up display for the wearer. In this embodiment some of the medical patient's vitals 52, such as heart rate and oxygen saturation (SpO_2)
20 are displayed. These vitals 52 are retrieved from a patient monitoring system (not shown) which is known in the art. Information representative of the vitals 52 is received by the receiver 42 and processed by the control unit 40 so as to be displayed on the display 50. In figure 5 the shield 1 is depicted in a situation in which the wearer is viewing the medical patient's arm 54
25 through the shield 1, sheet 2, and display 50. A previously acquired X-ray image of the arm is displayed on display 50 and thus bones 56 and 58 appear superimposed on the patient's arm 54 to the wearer. Data relating to the X-ray image can be stored in the data storage unit 44, e.g. be
30 downloaded into the data storage unit 44 prior to the operation. It is also possible that the receiver 42 receives the data relating to the X-ray image

from a medical database, e.g. during the operation. It is possible that the control unit 40 is arranged to remove the X-ray image from the display and replace it with another image, such as an MRI image, e.g. of the same portion of the patient. This way the user can switch between different
5 images, providing him with different types of information on the patient. Switching of the images may be controlled by a controller which is wirelessly or wiredly connected to the control unit 40. The controller may be attached to the shield 1 and/or to the display 50. The controller may also be a separate module, to be activated by the user or an assistant.

10 Figure 6 shows a disposable surgical face shield 1, wherein the display 50 is included outside the viewing region 10. Figure 6 is a front view of shield 1. In this embodiment the display 50 is arranged to be utilized by other medical professionals working along side the wearer. As an example an MRI image of the brain of the patient being treated is displayed on
15 display 50 of shield 1.

It will be appreciated that the control unit, the processing unit, data storage unit and receiving unit can be embodied as dedicated electronic circuits, possibly including software code portions. The control unit, processing unit, and receiving unit can also be embodied as software code
20 portions executed on, and e.g. stored in a memory of, a programmable apparatus such as a computer.

In the foregoing specification, the invention has been described with reference to specific examples of embodiments of the invention. It will, however, be evident that various modifications and changes may be made
25 therein without departing from the broader spirit and scope of the invention as set forth in the appended claims.

Although, all of the technical features of the embodiments of shield 1 as described with respect to Figs. 1-4 can be included in embodiments of figures 5 and 6, this is not a requirement. It will be
30 appreciated that the disposable surgical face shield including a flexible

liquid-impermeable screen arranged to extend over at least part of the facial region of a wearer including the display, the control unit, the data storage unit and/or the receiving unit, and optionally the processing unit, not necessarily comprises the spacers as described hereinabove.

5 It is possible, in the embodiment of figure 5, that the control unit 40 is provided with (or coupled to) a position sensor. The position sensor is arranged to determine the position of the display relative to the patient. The position sensor can also be arranged to determine the orientation of the display relative to the patient. Thereto the position sensor may e.g. make
10 use of GPS, a gyro, or the like. With the position sensor, the control unit 40 is able to determine an overlay of a given (set of) medical imaging data, such as (3D) CAT or MRI data. The overlay is determined such that the user sees, at the display 50 at the determined position and/or orientation, medical imaging data (an image) which is aligned with the view of the patient
15 through the display at the determined position and/or orientation.

 However, other modifications, variations, and alternatives are also possible. The specifications, drawings and examples are, accordingly, to be regarded in an illustrative rather than in a restrictive sense.

 In the claims, any reference signs placed between parentheses
20 shall not be construed as limiting the claim. The word 'comprising' does not exclude the presence of other features or steps than those listed in a claim. Furthermore, the words 'a' and 'an' shall not be construed as limited to 'only one', but instead are used to mean 'at least one', and do not exclude a plurality. The mere fact that certain measures are recited in mutually
25 different claims does not indicate that a combination of these measures cannot be used to advantage.

Claims

1. A disposable surgical face shield including
 - a flexible liquid-impermeable sheet which is transparent at least in the viewing region, and arranged to extend over the forehead region of the wearer and the nostrils and mouth of the wearer ,
 - 5 - a securing means for securing the shield to the head of the wearer,
 - a first spacer attached to the sheet and arranged to abut against the face of the wearer above the eyes, and
 - a second spacer attached to the sheet and arranged to abut
 - 10 against the nose bridge of the wear,

characterised in that the second spacer is inclined such that when the shield is mounted to the head of the wearer a proximal area of the second spacer proximal to the eyes of the wearer is positioned higher than a distal area of the second spacer distal to the eyes of the wearer.

 - 15
2. Disposable surgical face shield according to any one of the preceding claims, wherein the sheet when disengaged from the wearer's face is substantially flat.
- 20 3. Disposable surgical face shield according to claim 1 or 2, wherein the second spacer is mounted to the sheet in an inclined fashion.
4. Disposable surgical face shield according to claim 2, wherein the second spacer comprises an inverted V-shape.
 - 25
5. Disposable surgical face shield according to claim 1 or 2, wherein the second spacer is mounted to the sheet substantially perpendicularly, and wherein the second spacer comprises an inverted V-shape.

6. Disposable surgical face shield according to any one of the preceding claims, wherein the second spacer has lateral extent sufficient to extend over the cheeks of the wearer.
- 5 7. Disposable surgical face shield according to any one of the preceding claims, wherein a thickness of the second spacer, measured parallel to the sheet, increases from the center outwardly.
8. Disposable surgical face shield according to any one of the
10 preceding claims, wherein a height of the second spacer decreases from the center outwardly.
9. Disposable surgical face shield according to any one of the preceding claims, wherein the sheet is a self supporting sheet.
15
10. Disposable surgical face shield according to any on of the preceding claims, wherein the second spacer is impermeable to vapor.
11. Disposable surgical face shield according to any one of the
20 preceding claims, wherein the first spacer comprises a plurality of ventilation apertures.
12. Disposable surgical face shield according to any one of the preceding claims, wherein the second spacer comprises, or is made from, a
25 closed cell foam and wherein the first spacer comprises, or is made from, an open cell foam.
13. Disposable surgical face shield according to any one of the preceding claims, wherein the first and second spacer are connected by side

spacers to form a circumferential spacer arranged to enclose the viewing region including the eyes and excluding the nostrils and the mouth.

14. Disposable surgical face shield according to any one of the preceding claims, wherein the side spacers comprise, or are made from, an open cell foam.
15. Disposable surgical face shield according to any one of the preceding claims, wherein the first and/or second spacer, and optionally the side spacers, are arranged to be impervious to droplets and/or splashes of liquid.
16. Disposable surgical face shield according any one of the preceding claims, wherein the sheet is arranged to extend temple regions of the wearer.
17. Disposable surgical face shield according to any one of the preceding claims, wherein the first and/or second spacer, and optionally the side spacers, is arranged to catch droplets and/or splashes of liquid.
18. Disposable surgical face shield according to any one the preceding claims, wherein the first and/or second spacer, and optionally the side spacers, is arranged to absorb droplets and/or splashes of liquid.
19. Disposable surgical face shield according to any one of the preceding claims, wherein the first and/or second spacer, and optionally the side spacers, is arranged to hold droplets and/or splashes of liquid.

20. Disposable surgical face shield according to any one of the preceding claims, wherein the sheet includes, or is made from, a liquid repellent material at least in the viewing region.

5 21. Disposable surgical face shield according to any one of the preceding claims, wherein the sheet includes, or is made from, a liquid retaining material at least outside the viewing region.

22. Disposable surgical face shield according to any one of the
10 previous claims, wherein the sheet includes an antimicrobial substance arranged to interact with and/or inhibit the growth of one of a bacteria, virus, algae, fungi, and other microbes.

23. Disposable surgical face shield according to claim 22, wherein the
15 substance is included in the sheet as a coating, or wherein the substance is inherent to the material of the sheet.

24. Disposable surgical face shield according to any one of the preceding claims, wherein the sheet includes a strip of a super absorbent
20 material arranged to catch, absorb and/or hold droplets of liquid that land directly on the strip or slide from the sheet into the strip.

25. Disposable surgical face shield according to claim 24, wherein the strip of super absorbent material is attached to an edge of the sheet.

25

26. Disposable surgical face shield according to claim 25, wherein the strip of super absorbent material extends across a bottom of the sheet.

27. Disposable surgical face shield according to claim 25, wherein the
30 strip of super absorbent material extends across a top of the sheet.

28. Disposable surgical face shield according to any one of claim 24-27, wherein the strip of super absorbent material includes a plurality of strips of super absorbent material.

5 29. Disposable surgical face shield according to any one of claims 24-28, wherein the super absorbent material is a super absorbent polymer.

30. Disposable surgical face shield according to any one of claims 24-29, wherein the super absorbent material is a textile fabric, woven,
10 knitted or non-woven capable of capturing droplets via its structure.

31. Disposable surgical face shield according to one of claims 24-30, wherein the strip includes an antimicrobial substance arranged to interact with and/or inhibit the growth of one of a bacteria, virus, algae, fungi, and
15 other microbes.

32. Disposable surgical face shield according to one of claims 22, 23, and 31, wherein the antimicrobial substance is a metal ion such as a silver ion.

20

33. Disposable surgical face shield according to any one of the preceding claims, wherein the first spacer, second spacer and/or side spacer comprises an inner wall adjacent to the viewing region, wherein the inner wall includes an anti-glare strip.

25

34. Disposable surgical face shield according to any one of the preceding claims, wherein the first spacer second spacer and/or side spacer is attached to the screen by at least one of a weld, an ultrasonic bond, a rivet, and an adhesive.

30

35. Disposable surgical face shield according to any one of the preceding claims, wherein the securing means is one of an elastic strap, an adjustable elastic strap, a hook and loop strap, ear loops, head harness, and an adhesive.

5

36. Disposable surgical face shield according to claim 35, wherein the securing means is attached to the sheet by at least one of a weld, an ultrasonic bond, a slot, a rivet, and an adhesive.

10 37. Disposable surgical face shield according to claim 35 or 36, wherein the securing means is attached to the first spacer by at least one of a weld, an ultrasonic bond, a slot, a rivet, and an adhesive.

15 38. Disposable surgical face shield according to any one of the preceding claims, wherein the sheet includes a display and a control unit for controlling the display.

39. Disposable surgical face shield according to claim 38, wherein the display is included inside the viewing region.

20

40. Disposable surgical face shield according to claim 38 or 39, wherein the display is included outside the viewing region.

25 41. Disposable surgical face shield according to one of claims 38-40, wherein the display is an active matrix organic light-emitting diode (OLED) display.

30 42. Disposable surgical face shield including a liquid-impermeable screen arranged to extend over at least a viewing region including the wearer's eyes and a securing means for securing the shield to the wearer's

head, wherein the screen includes a display, and wherein the screen is provided with electrical contacts for interfacing to and controlling the display with a control unit.

5 43. Disposable surgical face shield including a liquid-impermeable screen arranged to extend over at least a viewing region including the wearer's eyes and a securing means for securing the shield to the wearer's head in combination with a display and a control unit wherein the display and control unit are releasably connected to the face shield.

10

44. Disposable surgical shield according to claim 42 or 43, wherein the display is included on an inside of the face shield.

15 45. Disposable surgical shield according to any one of claims 42-44, wherein the display is included inside a viewing region of the screen.

46. Disposable surgical shield according to any one of claims 42-45, wherein the display is included outside a viewing region of the screen.

20 47. Disposable surgical shield according to any one of claims 42-46, further comprising at least one of a data storage unit and a receiving unit for containing or receiving, respectively, data to be displayed on the display.

25 48. Disposable surgical face shield according to any one of claims 42-47, further including a sensor and/or camera arranged to transmit signals to the control unit, wherein the control unit further comprises a processing unit arranged to determine what part of the patient is being viewed by the wearer on the basis of the signals received from the camera and/or sensor.

30

49. Disposable surgical shield according to claim 47, wherein the processing unit is arranged to interact with a medical image database to determine what portion of a medical image corresponds to the portion of the patient being viewed by the wearer.

5

50. A method for manufacturing a disposable surgical face shield comprising:

providing a flexible liquid-impermeable sheet being dimensioned to extend over substantially the entire facial region of a wearer, wherein the sheet is transparent at least in a viewing region;

10

providing a securing means;

providing a first spacer being dimensioned to abut against the face of the wearer above the eyes;

15

providing a second spacer being dimensioned to abut against the nose bridge of the wearer;

attaching the first spacer to the sheet such that first spacer abuts against the face of the wearer above the eyes when worn; and

attaching the second spacer to the sheet such that the second spacer abuts against the wearer's nose bridge such that when the shield is mounted to the head of the wearer a proximal area of the second spacer proximal to the eyes of the wearer is positioned higher than a distal area of the second spacer distal to the eyes of the wearer.

20

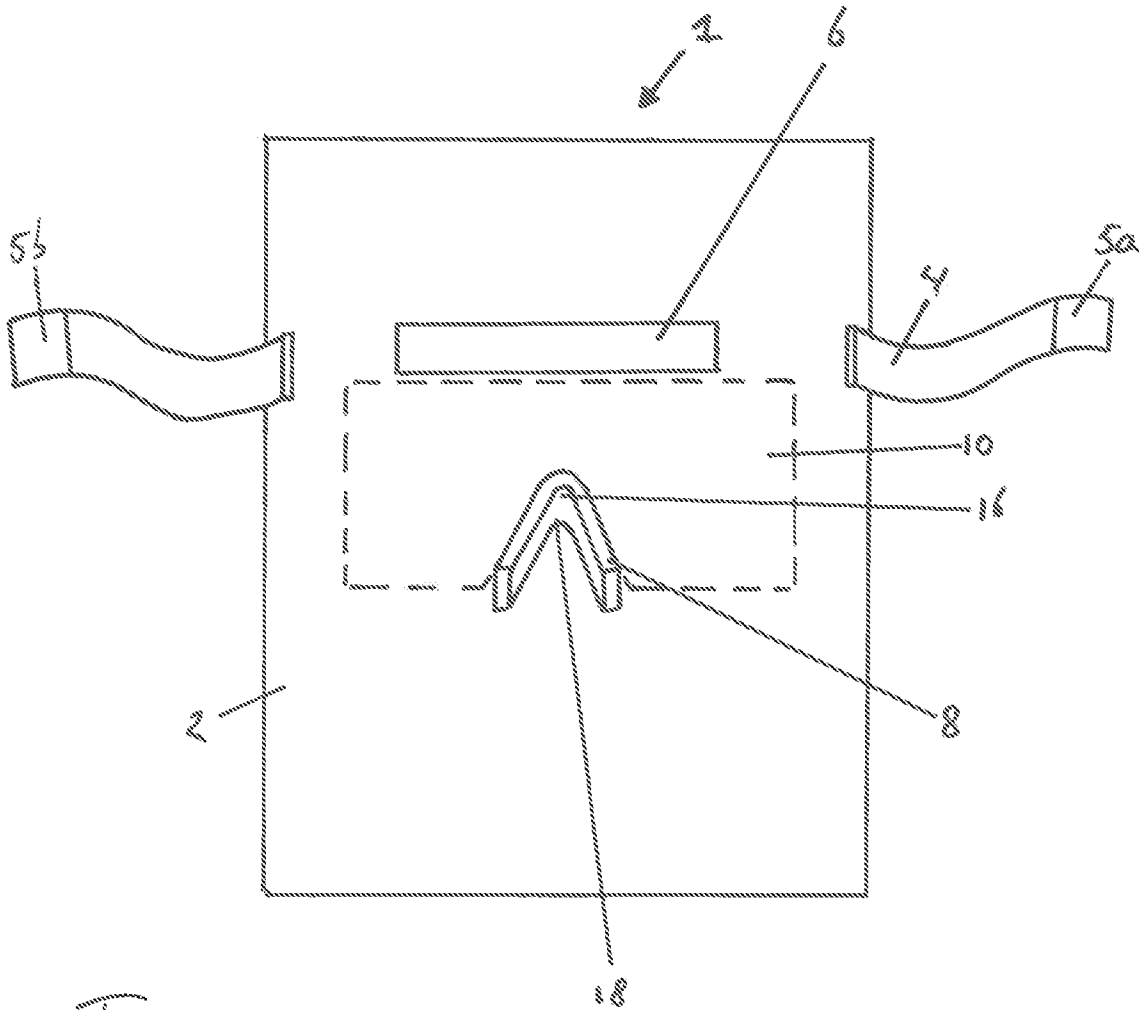


Fig. 1

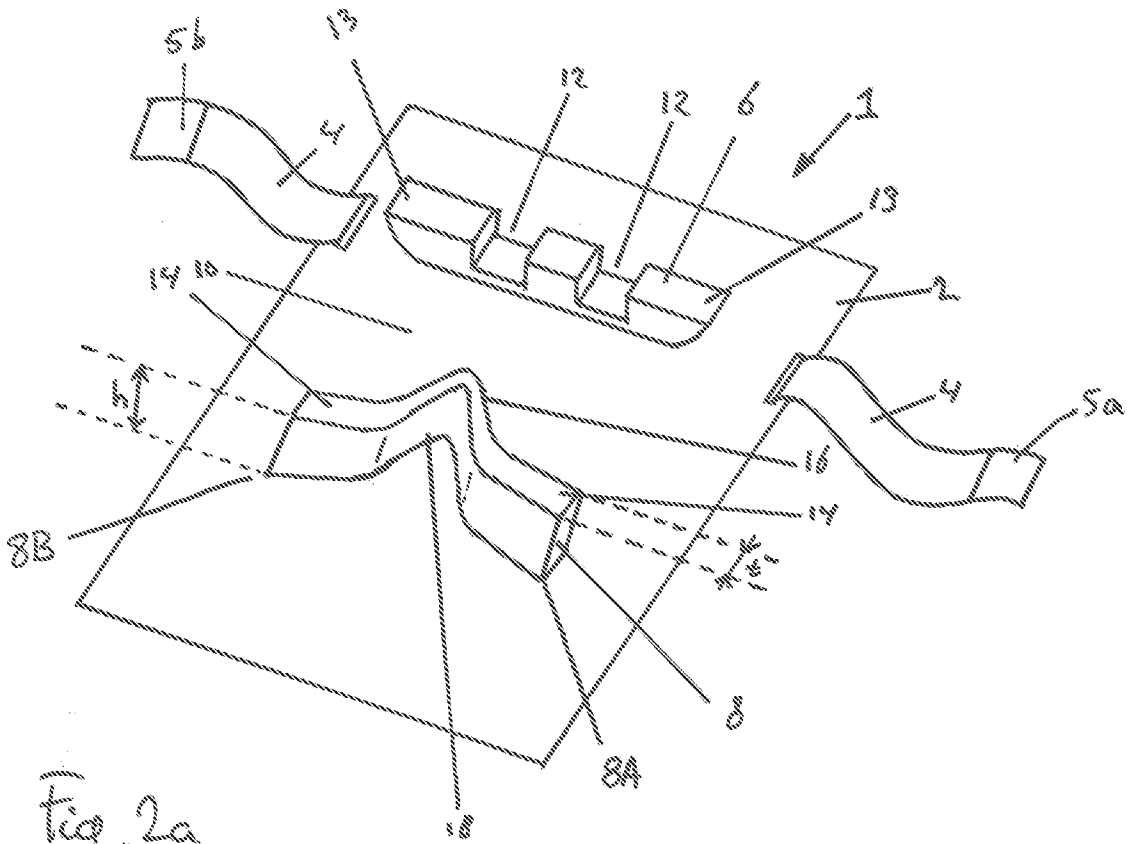


Fig. 2a

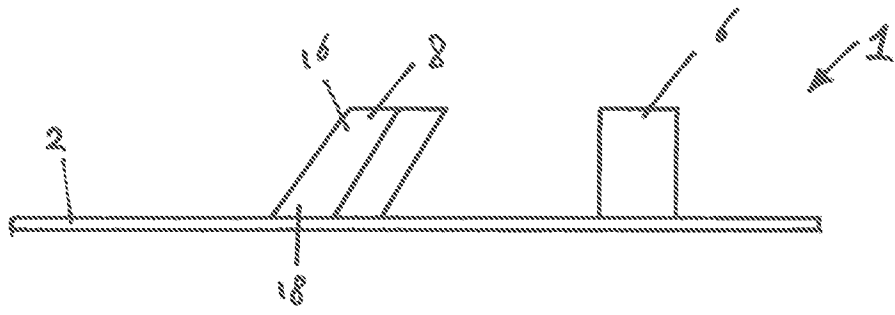


Fig. 2b

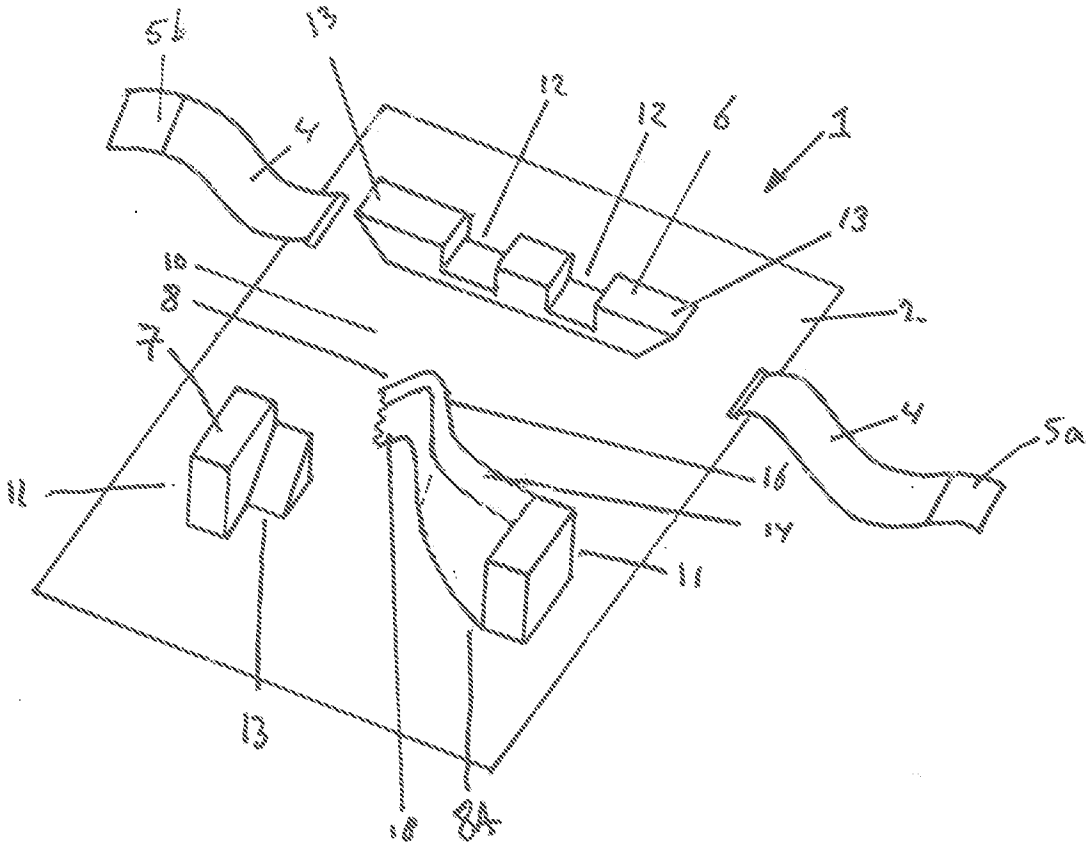


Fig 2c

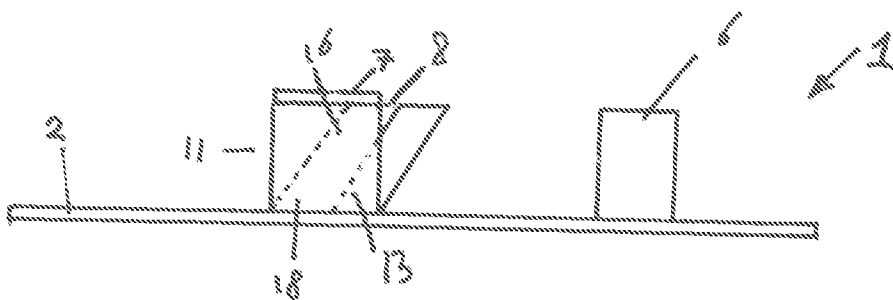


Fig 2d

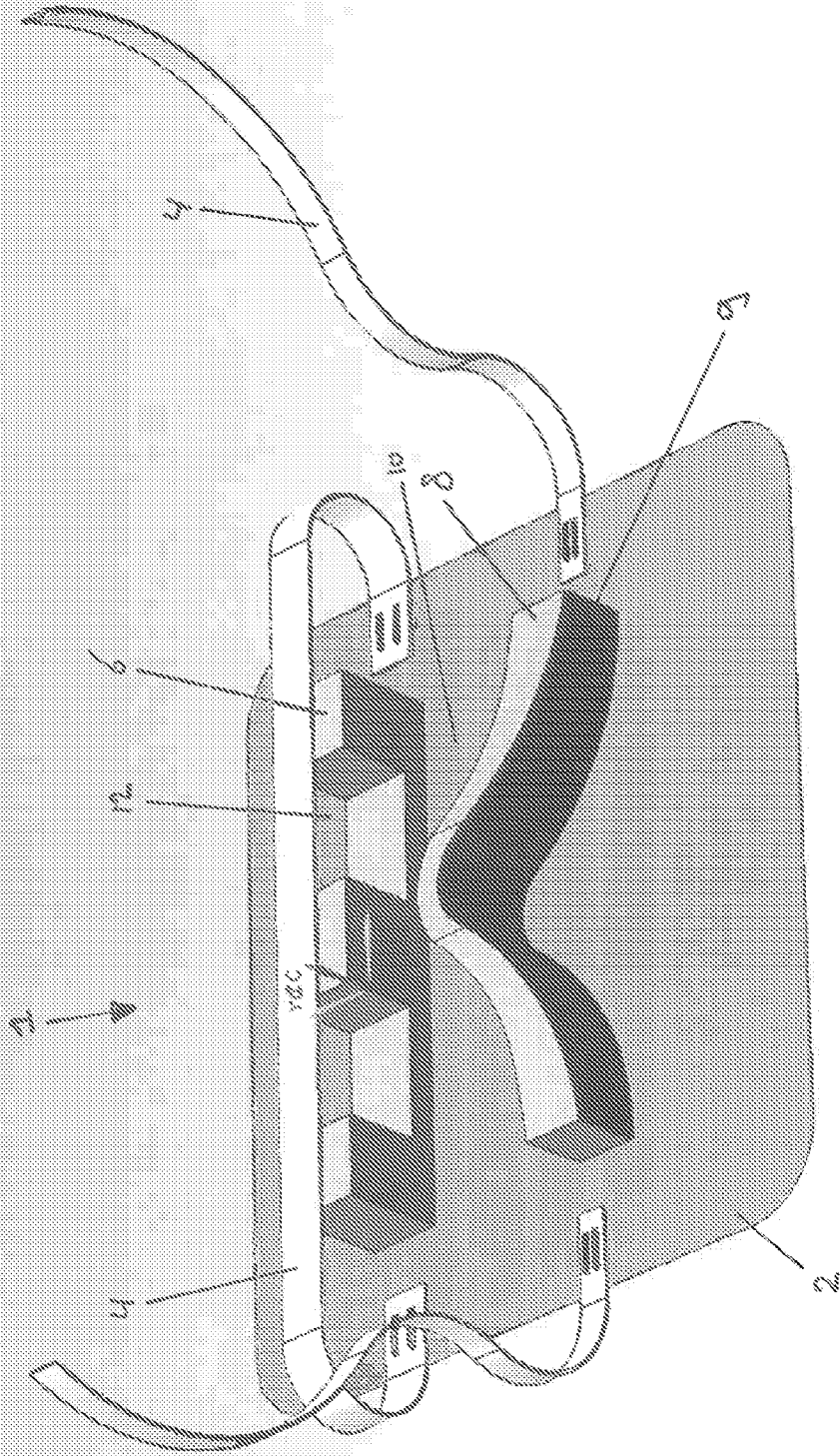


Fig. 3a

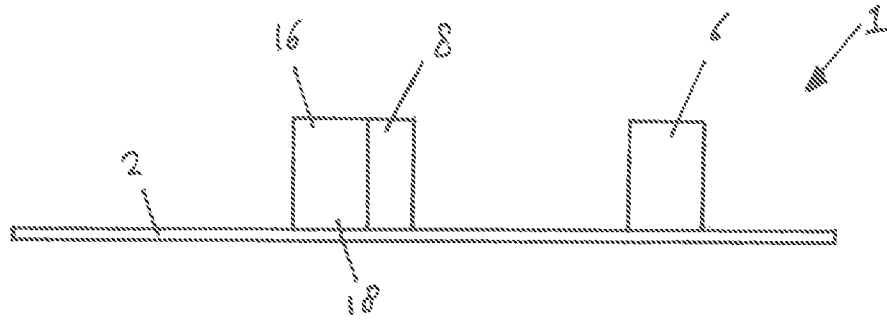


Fig. 3b

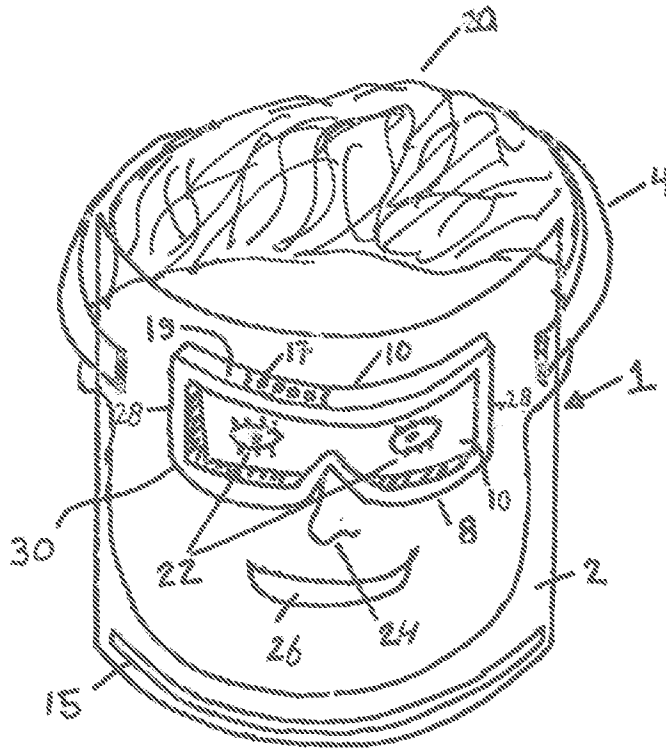


Fig 4

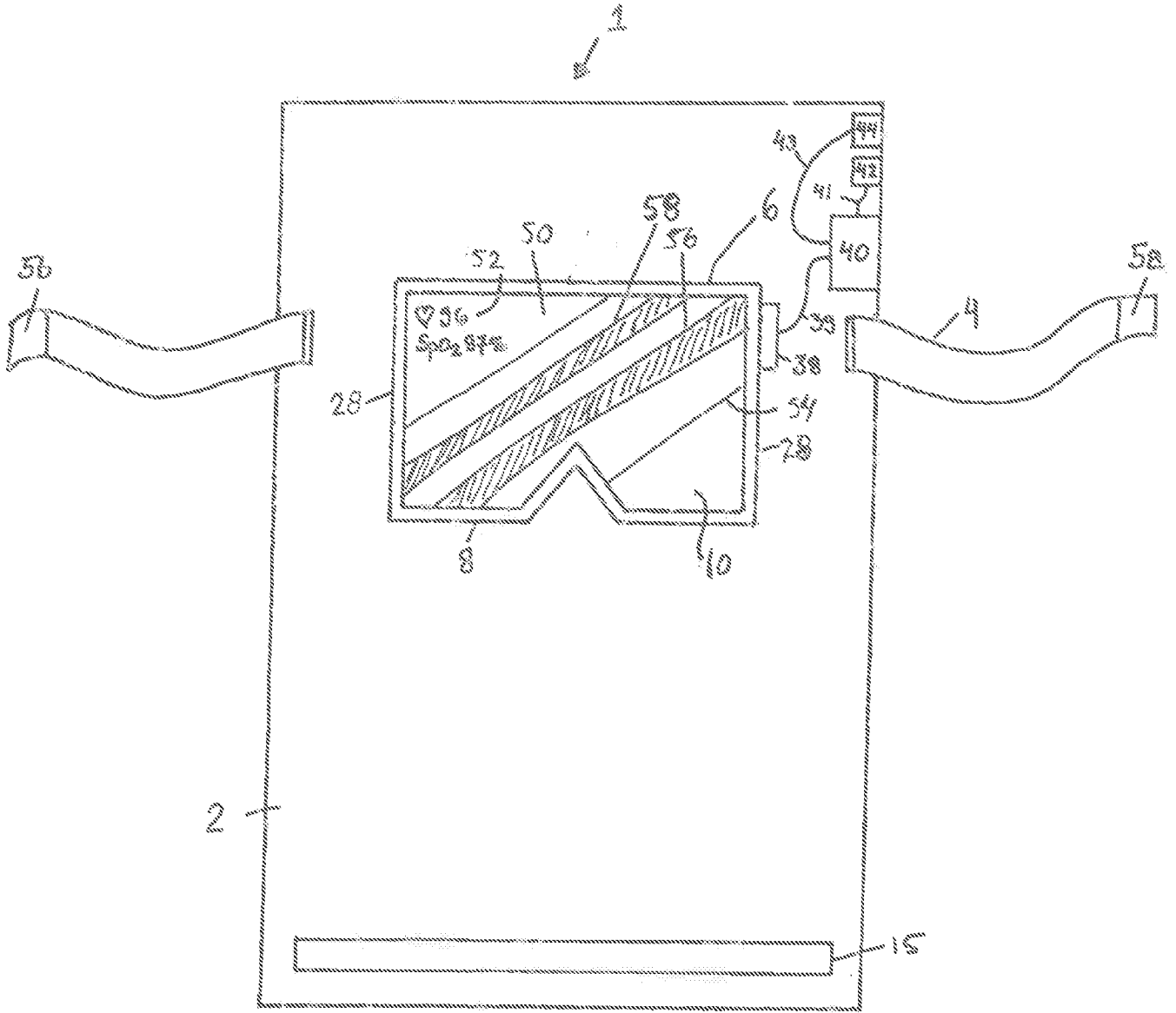


Fig. 5

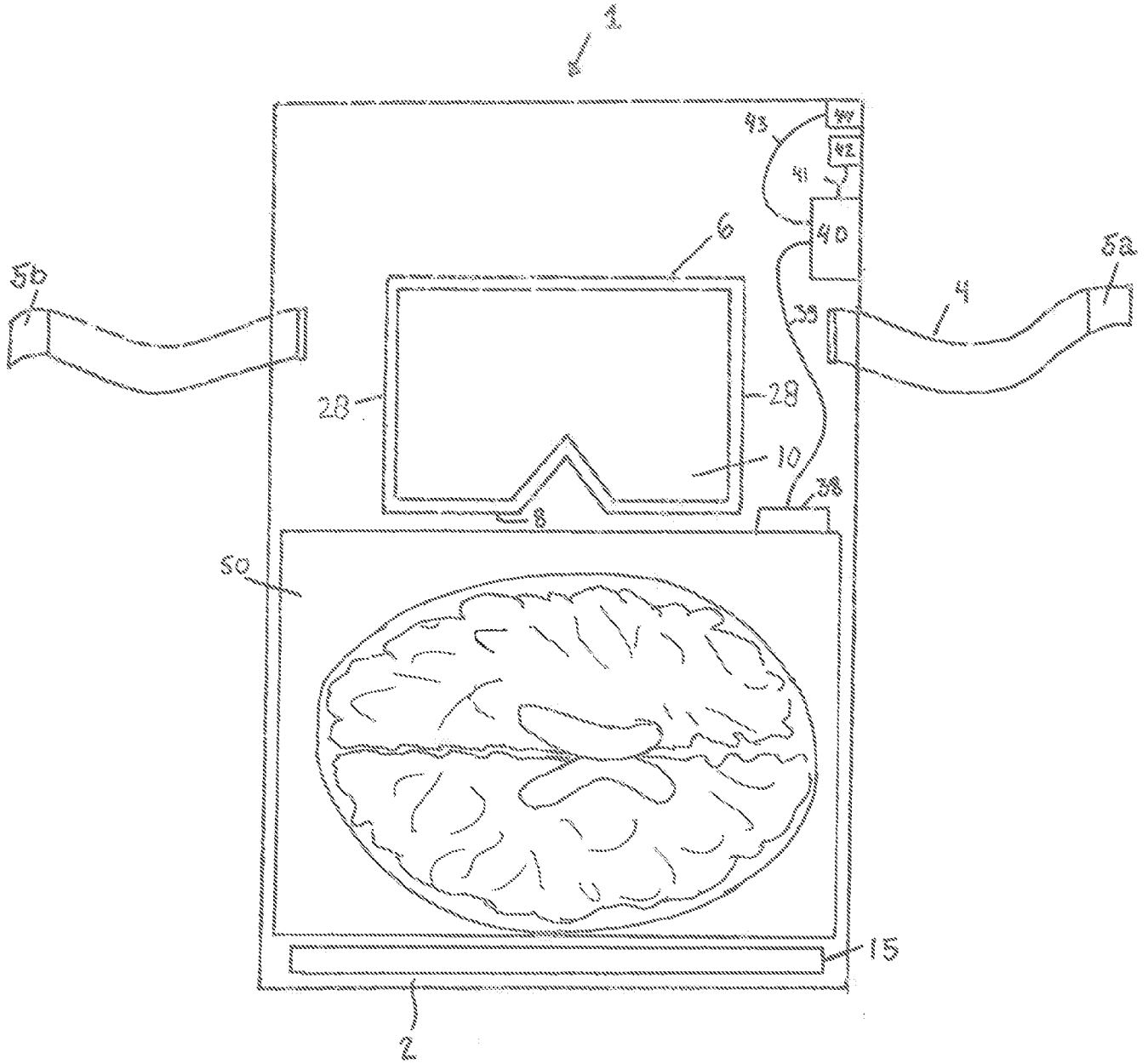


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2013/050382

A. CLASSIFICATION OF SUBJECT MATTER
INV. A41D13/11
ADD.

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 296 746 A (MASON JR STANLEY I ET AL) 27 October 1981 (1981-10-27) column 3, line 32 - column 5, line 68 -----	1-41,50
A	US 2 665 686 A (WOOD EDWIN E ET AL) 12 January 1954 (1954-01-12) column 1, line 1 - column 2, line 52; figures 1,2 -----	1-41,50
A	US 6 213 125 B1 (REESE GEORGE D [US] ET AL) 10 April 2001 (2001-04-10) claims 1-40; figures 11,12 -----	1-41,50
A	US 5 446 925 A (BAKER DENNIS L [US] ET AL) 5 September 1995 (1995-09-05) column 2, line 45 - column 5, line 5; figures 1-3 -----	1-41,50
	-/--	

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

12 December 2013

Date of mailing of the international search report

03/04/2014

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Simpson, Estelle

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2013/050382

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 584 078 A (SABOORY MAJID [US]) 17 December 1996 (1996-12-17) column 2, line 57 - column 3, line 62; figures 1-4	1-41,50
A	----- US 5 666 671 A (DANESHVAR YOUSEF [US]) 16 September 1997 (1997-09-16) claims 1-21; figures 1,2 -----	1-41,50

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NL2013/050382

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-41, 50

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-41, 50

Disposable surgical face shield having a particular arrangement of spacers.

2. claims: 42-49

Disposable surgical face shields provided with electronic display units.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/NL2013/050382

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4296746	A	27-10-1981	NONE
US 2665686	A	12-01-1954	NONE
US 6213125	B1	10-04-2001	AU 3871999 A 16-11-1999
		CA 2329541 A1	04-11-1999
		DE 19983185 T1	10-05-2001
		GB 2353941 A	14-03-2001
		JP 2003527133 A	16-09-2003
		US 6213125 B1	10-04-2001
		WO 9955180 A1	04-11-1999
US 5446925	A	05-09-1995	CA 2133260 A1 28-04-1995
		DE 69415630 D1	11-02-1999
		DE 69415630 T2	17-06-1999
		EP 0650712 A1	03-05-1995
		ES 2126043 T3	16-03-1999
		JP H07178117 A	18-07-1995
		US 5446925 A	05-09-1995
US 5584078	A	17-12-1996	NONE
US 5666671	A	16-09-1997	NONE