(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 632 248 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
20.03.2024 Bulletin 2024/12

(21) Application number: **18810853.4**

(22) Date of filing: **24.04.2018**

(51) International Patent Classification (IPC):
A41D 13/11 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A41D 13/1138; A41D 13/1161

(86) International application number:
PCT/RU2018/000267

(87) International publication number:
WO 2018/222081 (06.12.2018 Gazette 2018/49)

(54) BARRIER-DISCHARGE-TYPE MEDICAL MASK WITH FRAME (VARIANTS)

MEDIZINISCHE MASKE VOM BARRIEREENTLADUNGSTYP MIT RAHMEN (VARIANTEN)

MASQUE MÉDICAL DE TYPE À BARRIÈRE ET À ÉVACUATION (ET VARIANTES)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **30.05.2017 RU 2017118581**

(43) Date of publication of application:
08.04.2020 Bulletin 2020/15

(73) Proprietor: **MPOINTAERO Inc.**
Fairfax, VA 22030 (US)

(72) Inventors:
- **BELOUSOV, Vladimir Egorovich**
  Kirovsk, Leningradskaya obl. 187340 (RU)
- **BELOUSOV, Maksim Vladimirovich**
  Kirovsk, Keningradskaya obl. 187340 (RU)

(74) Representative: **Cooley (UK) LLP**
22 Bishopsgate
London EC2N 4BQ (GB)

(56) References cited:
CN-Y- 2 162 260
JP-A- 2005 185 381
RU-C2- 2 187 232
RU-U1- 32 368
SU-A1- 1 784 234

EP 3 632 248 B1

Description

Field of the Invention

[0001] **The claimed group of inventions relates** to human personal protective equipment, namely to face masks intended to be used predominantly in medicine.

[0002] This invention, represented in three versions, is:

- universal environmental and hygienic protection for both surgeon and patient while medical aid of any level of complexity is being performed, including prolonged surgical procedures;
- personal protection for the civilian population against airborne infections including influenza.

[0003] The difference between the versions of the medical face masks is stipulated by their primary application area: universal, surgical, or clinical.

[0004] As opposed to medical filter masks, they relate to barrier- and discharge-type face masks, i.e. those that fully prevent the passage of exhaled air and expel exhaled air in the intended direction. Structurally, each version of the mask is a hollow frame.

Background Art

[0005] Various options for the designs of barrier medical face masks and framed face masks are available from the background art.

[0006] From the document (the journal "Surgery Reporter n.a. 1.1. Grekov" No. 12, 1969, authors: academician of the Academy of Medical Sciences, prof. S.M. Kurbangaleyev et al.) a barrier surgical face mask is known, which is made of hard plastic as a textured shield that fits the face tightly. The mask was tested during 2,000 surgical procedures at the First Leningrad Institute (the First Saint Petersburg State Medical University) n.a. academician I.P. Pavlov and demonstrated its exceptional aseptic properties. The unquestionable advantage of the barrier face mask (in the form of an air-tight shield), by comparison with filtering (standard medical) masks, in terms of the efficiency of patient protection against respiratory infections during surgical procedures, was experimentally and clinically proven.

[0007] The disadvantages of the given design are the following:

- a large quantity of exhaled air remains in the undermask area, and thus the face becomes overmoistened and overheated - a greenhouse effect occurs, causing a general feeling of being unwell and decreasing the surgeon's productivity;
- it is a rigid structure that tightly fits the facial area over a long period of time.

[0008] Despite a high level of patient protection during surgical procedures, the aforementioned disadvantages greatly affect the surgeon's performance by decreasing it to an unacceptable level, therefore this type of mask is not used in the medical practice.

[0009] A respiratory face mask is known from document CN2162260 Y published on 04.20.1994, which is intended for nasal and oral breathing. It consists of two boxed side frames combined into an integral structure with through holes, and a rigid shield located between them in front of the nasal-oral area. The mask is functionally divided into the front, right, and left sectors, where the left sector and the right sector represent the side containers that contain the filtering elements. All the exhaled air is removed (similarly to a respirator) via valves, and the inhaled air is filtered. A partition situated between the containers acts as a partial barrier (shield) to protect the surface of the face against moisture penetration from outside.

[0010] The disadvantages of the given design are the following:

- there is almost no natural ventilation in the undermask area, resulting in the accumulation of a high level of CO_2 and moisture, which gradually diminish the wearer's state of wellness;
- the large number of filtering elements creates high resistance for breathing, which considerably affects the wearer's performance;
- it is a rigid structure that tightly fits the facial area over a long period of time.

[0011] This general disadvantage is inherent to both the analogs.

[0012] Aimed at ensuring the necessary obturation, the close contact of a rigid, non-elastic structure with the surface of the face results in the prolonged compression of nerve fibers and blood vessels, which causes pain, local paraesthesia, and pronounced discomfort, which make this kind of mask practically unusable.

[0013] As the closest analog, the applicant has selected the following information source: Russian Patent No. 2240160, dated 11.20.2004, from which a medical framed barrier and discharge face mask is known.

[0014] Similarly to the claimed versions of the invention:

- Structurally, the mask is a hollow frame;
- The outer portion of the frame is made of an air-impermeable material (medical plastic). The inner part (contacting the facial surface) is made of the soft and elastic fabric, which prevents from compression of the face nerve fibers and blood vessels by the mask;

- It performs barrier and discharge functions;
- It causes no resistance to breathing.

[0015] A number of essential features distinguish the analog's frame from the claimed invention:

- by tightly fitting the surface of the face, it covers its bottom and middle (according to the classification by R.A. Reiss) sections: from the chin to the level of the bridge of the nose;
- the under-mask space forms a uniform nose-and-mouth cavity.
- the facial (inner) portion of the frame has a combined cut-out around the nasal and oral area;

[0016] The disadvantages of the given design are the following:

- in a large under-mask area (predominantly during the oral breathing), the overaccumulation of moisture takes place and the CO_2 level rises, which partially decreases the surgeon's performance;
- the physiological differences in human breathing via the nose or mouth are not taken into account, resulting in an inadequate decrease in the mask's hygienic properties;
- similarly to its analogs, the mask is not universal, since the form of the mask depends on the surface relief of the face, which ultimately diminishes its consumer properties;
- wearing the mask hinders the movement of the lower jaw, thus decreasing its communicative potential - it impedes speech.

[0017] JP 2005 185381 aims to provide a mask which can be worn for a long period of time without the user feeling stuffy and which prevents dispersion of expiration to others. The mask is provided with a mask body which comprises a jaw pad part and a mouth front development part, and an attachment string; the mask body has a morphological stability capable of retaining the form of itself; the jaw pad part is formed into a shape applied to the jaw of a person from the lower part to stabilize the mask body; the mouth front development part is formed into a form that extends from the jaw pad part to the nose front with its upper part separated from the face and develops from the mouth front to the nose front to be worn; and the attachment string is disposed in such a positional relation that the adjacency of the jaw pad part is pulled from the ear till abutting on the jaw and stabilized. The mask body is a single part and is not configured as a hollow frame. The attachment string passes through a hole in the mask. This hole is not suitable for the passage of air.

Disclosure of the invention

[0018] In accordance with one aspect of the invention, there is provided a medical framed barrier and discharge face mask as defined by claim 1. In other aspects of the invention, there are provided medical framed barrier and discharge face masks as defined by claims 10 and 12. Optional features are defined by the dependent claims.

[0019] The reduction in a surgeon's performance capability during surgical procedures as a result of the sharp deterioration of the breathing conditions in a filtering medical mask considerably affects the quality of his/her work. In addition, as a rule, filter medical face masks lose their protective properties after half an hour of use. As a result, we can observe a relatively low quality of surgical procedures and a high level of post-surgery complications all over the world.

[0020] Standard filter medical masks, due to their design features, lack the possibility of protecting the general population against viral infections and a number of hazardous bacteria, which is most relevant during epidemics.

[0021] A different protection principle for patients and the general population is suggested, by means of creating an impermeable barrier against airborne infections without impeding the respiratory ability of the user. In addition, a number of other major problems are solved, leading, for example, to the preservation of the performance capability of medical personnel throughout the entire working time.

[0022] **The purpose of this group of inventions** of medical face masks is to eliminate the deficiencies of the prior art as well as to achieve the following results:

- the elimination or significant reduction of CO_2 accumulation in the under-mask space, as well as preventing an increase in moisture and temperature level, i.e. solving the prototype's basic hygiene issues;
- the implementation of various methods of protection against airborne infections in line with the state of the environment and the nature of the wearer's work;
- improved comfort and efficiency when using the masks, due to the adequacy of their protection during oral or nasal respiration;
- the reduced accumulation of airborne infections in an enclosed space (for example, in an operating theatre), due to their complete or partial neutralization in the mask, by comparison with analogs and medical filter masks;
- since the shape of the masks does not depend on the relief of the facial surface, universality is achieved;

- the masks do not impede the mobility of the lower jaw, i.e. they do not affect the wearer's communicative abilities.

[0023] The technical result of the claimed group of inventions is:

- improved labor conditions for medical staff throughout the entire period of use of the mask with full protection against the penetration of infection in the area of the surgical field and any liquid media into the respiratory system of the user, both from the surgical field and from the consumer/surgeon;
- full protection of the wearer against airborne infections in public areas, as well as
- protection of the human respiratory organs against aggressive environments in different professional areas of activity without any loss of productivity.

[0024] The claimed technical results are achieved via the design embodiment of the medical face mask according to three options, each of which complements or focuses the capabilities of the previous one, while providing it with new consumer properties.

[0025] All the mask options have one common inventive concept; namely, they contain a hollow frame that forms an under-mask space for the lower part of the face, which is made in the form of a channel, with an airtight outer surface and an inner surface (closest to the surface of the face) made of breathable fabric. The frame channel contains an air inlet and outlet on each side (on the left and on the right) for the airflows that are formed during inhalation/exhalation. As a rule, the side that comes into contact with the surface of the face has a cutout around the mouth.

[0026] Structurally, various functional spaces are formed within the mask: an area for oral respiration and an area for nasal respiration. In the mouth area (the lower part of the face), each version of the mask is made in the form of a hollow frame. In the middle part of the face (in the nasal area), depending on the version, a separate zone for nasal respiration is formed, which may be open, half-open, or closed.

[0027] All of the versions are fixed to the head area using standard means: with straps, elastic bands, etc.

[0028] The face mask is positioned on the head in such a way that the exhaled air is almost entirely expelled backwards, to an area that is safe for people around the wearer.

[0029] Due to the separation of the mask space into two relatively independent zones, optimal conditions for breathing are achieved, which take into account the physiology of nasal and oral respiration. The presence of a cavity in the frame ensures additional ventilation and conditioning of the under-mask space.

Medical Face Mask, option 1.

[0030] The face mask is universal, i.e. it is intended for use by the general population as well as in medical institutions. It may be applied as the basic version (the simplest one) or may be a combination of a frame mask and additional components.

[0031] As distinct from the prototype, the mask frame covers the lower part of the face, providing complete protection only to the mouth area - the main source of airborne infections and the gateway for the penetration of infections from outside. For maximum preservation of the wearer's performance capabilities, nasal respiration has been left entirely unimpeded, which is especially important for healthy wearers with undamaged nasal mucosa. In order to minimize breathing resistance, the mask frame sides are extremely short by comparison with the prototype.

[0032] The hollow mask frame consists of two parts, which form its outer side and inner side, which comes into direct contact with the surface of the face. The outer part of the frame is airtight and is generally made from transparent medical plastic, thus improving the wearer's communicative abilities. If mask transparency is irrelevant, its outer portion may, for example, be made of a dense cloth or paper. The inner part of the frame, i.e. the side that comes into contact with the surface of the face, is made of breathable and, generally, elastic fabric, for example, spunbond fabric or medical gauze. In order to reduce overall breathing resistance, a cutout around the mouth area may be located on the side that comes into contact with the surface of the face. If a fabric with low breathing resistance is used for the inside of the frame (for example, 1- or 2-ply gauze), then a cut in the mouth area is not appropriate.

[0033] For transportation convenience, the mask may have special devices for folding it: from a dimensional to a flat shape. For example, the outer part of the frame may have folds in the form of corrugations or pleats. With this design, the mask is put on folded and takes shape as a result of forced exhalation.

[0034] In its basic version, the mask (without any additional components) is mainly intended for the civilian population, for example, to prevent the spread of an influenza epidemic in public areas.

[0035] The additional components of the mask increase its protective properties, thus extending the scope of application to include medical facilities.

[0036] A further description is given with reference to figs. 1 of the drawings that show the designated positions of structural components, such that a specialist can better understand all the aspects of disclosure of the nature of version 1 of the claimed technical solution.

[0037] The design of medical barrier and discharge face mask version 1 is shown in fig. 1.

[0038] The frame of the mask for the lower face part 1 includes the outer air-impermeable side of the frame 2 (shown transparent), made of plastic, for example,

through which the inner breathable side of the frame 3 can be seen. This may be made, for example, of fabric and come into contact with surface of the face. It is provided with a cutout 4 around the mouth area. On both sides of the head, the frame forms lateral air holes (inlet/outlet) 5 for the passage of the air flow.

[0039] The nasal area is fully open, i.e. nasal inhalation and exhalation are unhampered. The upper edge of the frame, which passes directly under the nose, partially expels the air that is exhaled through the nose due to its geometry.

[0040] When inhaling through the mouth, air from the exterior penetrates the cavity of the frame through the lateral air holes 5 and then passes through cutout 4 in the side that comes into contact with the surface of the face 3. In the absence of a cutout, it passes through the breathable fabric.

[0041] During oral exhalation, air is initially supplied to the frame cavity and then is expelled via the side air supply openings 5. Due to the air impermeability of the outer side of the frame 2, the exhaled air, with any moisture contained in it, is entirely directed backwards - in the opposite direction. The side of the frame that comes into contact with the surface of the face 3, due to its elasticity and hygroscopicity, prevents the compression of nerve fibers and blood vessels in the facial area, does not cause discomfort or pain, and prevents moistening (maceration) of the facial area.

[0042] To extend the protective properties of mask version No. 1, the following additional components are used.

1. A breathable material 6 extends beyond the frame and contains an additional device 7 for partial retention of the moisture contained in the exhaled air. Device 7 can be made in the form of folds or strips of fabric, for example, and, if necessary, be soaked in a special antiseptic agent. There may be several of these devices 7 on each side of the mask.
2. The air inlet and outlet, i.e. the side air opening 5 of the frame, contains an additional component 8 in the form of a spoiler on its outer (breathable) part, which directs exhaled air to the material 6 that comes into contact with the surface of the face. This extends beyond the frame and contains an additional device 7, for partial retention of the moisture contained in the exhaled air. The spoiler may be an extension of the outer side 2 of the frame or be a separate part that can be attached with glue, adhesive tape etc., for example. The spoiler may be made, for example, of a material with specialized properties: bactericidal, adhesive, etc.

[0043] The breathable material of the mask may be either single-ply or consist of several layers, each of which may have various useful properties, for example, bactericidal action against different types of microbes, etc. All the materials applied (in each of the layers) are identical to those that are widely used in medical practice and have the appropriate certificates.

[0044] The plastic and fabric parts of the mask may be factory joined (stitched, glued) or be connected by the wearer himself/herself, for example, by using adhesive tape.

[0045] The mask is attached/fixed on the wearer's head area using devices 9, for example, ties, straps, elastic bands, etc.

Medical Face Mask, option 2

[0046] This version of the mask is primarily intended for use in surgery and boasts the maximum protection for the doctor and patient in the conditions of surgical operations. It is aimed at the maximum preservation of the working capacity of medical staff.

[0047] This option is a combination of two types of mask: frame and shield-shaped, forming two different mask spaces: the lower frame, in the mouth area, and the shield, in the nose area. A partition is formed between the shield and the frame, containing an air opening for passage of air that is exhaled through the nose into the frame cavity. In this opening, if necessary, a valve may be installed to direct the air that is exhaled through the nose towards the frame and prevent the penetration of any air exhaled through the mouth into the under-mask space.

[0048] The shield is airtight and is located at some distance from the surface of the face, so that nasal breathing remains practically unimpeded.

[0049] The main purpose of the mask shield is to direct (by virtue of its aerodynamics) the air exhaled from the nose directly into the cavity of the frame, which completely prevents it from getting towards the surgical field. This solution allows a surgeon to maintain a high quality of the main (nasal) type of breathing during surgery, while enhancing his/her performance.

[0050] Structurally, in the partition between the shield and the frame, there may not be an air opening, however, in this case, the aerodynamics of the air flow that is regulated by the shield becomes entirely irregular, which significantly reduces the consumer properties of the mask.

[0051] In addition, the shield protects the nasal area and also partially protects the middle part of the face from external pathological factors during surgery: biological fluids, airborne infections, etc. This is also relevant to improving the surgeon's safety.

[0052] During an operation by the surgical team, the air exhaled by the personnel, in contrast to filter masks, is fully discharged into the non-sterile area of the surgery room. This ensures a high level of sterility in the surgery area itself, i.e. it contributes to a reduction in the risk of post-surgery complications. Consequently, the overall quality of treatment provided by a medical facility is improved.

[0053] A further description is given with reference to figs. 2 of the drawings that show the designated positions

of structural components, such that a specialist can better understand all the aspects of disclosure of the nature of the claimed technical solution according to version 2.

[0054] The frame of the mask that is located in the lower face part 1 includes the outer airproof part of the frame 2 (shown transparent), which can be made of, for example, plastic, and through which the inner breathable side of the frame 3 can be seen. This is made, for example, of a fabric material and has a cutout 4 around the mouth area. On both sides of the head, the frame forms lateral air holes (inlet/outlet) 5 for the passage of the air flow.

[0055] As opposed to option No. 1, in order to discharge the exhaled air as far as possible from the surgical field, the sides of the frame are as elongated as possible.

[0056] The frame also has an air-impermeable shield 10, which covers the lower part of the nose. There is a partition between the shield 10 and the frame 11 with an air opening. There can be multiple similar openings in the partition, which might be identical or take various shapes.

[0057] Fig. 2 shows that the shield 10 is located at some distance from the surface of the face, thus forming a slotted space.

When inhaled through the nose, air freely penetrates through this slotted space. When exhaled through the nose, all air, due to the aerodynamic properties of the shield, is directed from top to bottom, through the air opening in the partition 11. It goes into the frame cavity and then exits through the side air openings 5 (inlet/outlet) for air flow passage.

[0058] Oral breathing occurs similarly to No.1. For the complete elimination of air ingress from the frame cavity into the under-mask space of the middle part of the face (if necessary), one or more valves may be installed in air openings in the partition 11.

[0059] However, if the inner cavity of the frame is made to take into account the aerodynamics of air flows passing through it, the relevance of the valve is decreased or removed.

Medical Face Mask, option 3

[0060] The main purpose of this version of the mask is general clinical utilization. The mask can be recommended for use in all types of medical institutions, including departments of infectious disease and for the provision of all types of medical care, from outpatient to infection surgery. It is intended to maximize the protection of medical staff without significant loss of its performance capacity. A particular feature of this mask option is its ability to transform and adapt to specific working conditions of medical staff.

[0061] The design of this type of mask is a hybrid consisting of three types of masks: frame, shield-shaped, and filter. Accordingly, it combines the functions of all types of well-known medical masks: barrier and discharge, barrier, and filter.

[0062] The fundamental differences between option No. 3 and the first two options are as follows:

1. The mask may have two states: initial and working. In the initial state, the mask practically does not differ from option No. 2 in terms of functionality.
In this state, breathing remains unimpeded. Consequently, in a similar position, it can be used, for example, for conventional surgical procedures. If, there is a hazard of infection, the mask can be converted into the working state, i.e. all air flows that occur during oral and nasal inhalation and exhalation are directed through the built-in filters. A similar hazard exists, for example, when medical workers move from a clean zone into an infectious ward. When leaving the ward, there is no hazard of infection, and the mask is returned to its initial state, in which conditions for breathing are significantly improved. Immediately during urgent surgery (an emergency), it often turns out that the patient has a concomitant infectious disease. In this situation, the surgeon, without interrupting the operation and without removing the mask, may switch it to its working state, i.e. quickly protect himself/herself.

2. The hollow frame for the lower part of the face is divided into three functionally different sectors: the central one and two side ones.

3. The outer walls of the side sectors of the frame are air filters made of materials used in the production of standard (filter) medical masks, such as spunbond fabric.

4. The side walls of the frame may be homogeneous or consist of serially connected segments, each of which may be a filter of a different density, i.e. filters designed for different types and levels of infection.

5. The channel of the frame has a device to close it, with the possibility of reopening it in order to direct air flows during inhalation and exhalation either through the inlet/outlet (side openings) or through the built-in filter.

6. If the side walls of the frame consist of multiple segments, then each segment may have a separate device to close it, which may be made in the form of adhesive tape or a special latch, for example.

7. The mask shield, as a rule, is made entirely of filter material used in standard medical masks or, if it is necessary to provide it with aerodynamic properties, consist of a combination of an air-impermeable material and filter fabric. Similarly to option No.2, the shield does not come into contact with the surface of the face.

8. A device is built in around the edges of the shield

fabric to ensure that it fits the contour of the face, around the dorsum nasi. This might be, for example, an adhesive strip, a ductile wire, an elastic bracket, etc.

9. There is a partition between the frame and the shield separating the two under-mask spaces, which, as opposed to version No. 2, can be made without an air opening. If the shield consists entirely of fabric, then its aerodynamic properties are not relevant. At the same time, in the working state, the absence of air openings in the partition provides a higher level of protection of the mask.

[0063] A further description is given with reference to fig. 3 of the drawings that shows the designated positions of structural components, such that a specialist can better understand all the aspects of disclosure of the nature of the claimed technical solution according to version 3.

[0064] The design of medical barrier and discharge face mask No. 3 is shown in fig. 3.

[0065] The frame of the mask that is located in the lower face part 1 includes the outer airproof part of the frame 2 (shown transparent), which can be made of, for example, plastic, and through which the inner breathable side of the frame 3 can be seen. This is made, for example, of a fabric material and has a cutout 4 around the mouth area. On both sides of the head, the frame forms lateral air holes (inlet/outlet) 5 for the passage of the air flow.

[0066] This mask version can be used in two states: initial (open) and working (closed).

[0067] In the initial position, the shield 10 does not come in contact with the surface of the face and inlets/outlets 5 are open to allow the passage of air flows.

[0068] In fig. No. 3, medical mask version No. 3 is shown in the working (closed) state.

[0069] The shield 10, made of filtering and, as a rule, single-ply material (for example, spunbond fabric or medical gauze), fits tightly to the contour of the face around the dorsum nasi. As a result, the mask space in the nasal area is fully closed, and nasal inhalation/exhalation occurs through the filter fabric of the shield. A partition 11 is formed between the shield and the frame, which, as distinct from version No. 2, may not contain an air opening.

[0070] The outer side of the side sections of the frame, as distinct from options No. 1 and 2, consists of segments 12 made of filter fabrics (side filters). The wall of each segment 12 may consist of filters of different densities or of a different number of layers of fabrics (for example, spunbond fabric). A device 14 for closing the channel is located on the outer boundary 13 of each segment (shown only for the middle segment). As a result, during oral inhalation/exhalation, air passes only through the side filters 12.

[0071] In order to preserve the framed structure (air channels) of the side segments of the frame, shaping supports (for example, a coarse mesh of nylon) may be installed between the fabric layers of its outer parts. The mesh can be woven into the fabric in the form of individual fibers, or the fabric itself, in the form of a mesh, may be soaked in a shaping solution (for example, starch).

[0072] The breathable material of the frame, the filters in the side segments, and the shield may be made of fabrics with different functional properties or of the same fabrics (used in medical practice as standard).

[0073] In versions 2 and 3 of the masks, as distinct from in the prototype, the shield does not come into contact with the surface of the face in the area of the dorsum nasi. The resulting gap is used not only used to supply air during nasal inhalation, but also to allow for the free movement of the plastic part such that it can follow the movements of the lower jaw.

[0074] Therefore, the connection between the mask parts does not impede the free movement of the lower jaw, which allows for communication during surgery, for example. In option No. 3, the shield 10 is made of fabric with a degree of surplus so as not to impede the movement of the lower jaw during conversation.

[0075] Each version of the mask may have various additional devices or features and may be made of different materials, or using different technologies.

For example:

For additional protection in the area around the eye and of the rest of the surface of the face, the plastic part of the mask may have an additional structure in the form of a transparent shield.

[0076] In order to increase communicative capabilities, the outer side of the mask may be fully or partially transparent; it may be made of plastic, as shown in figures 1-3. With design aims in mind, the plastic may be of different colors, and various inscriptions and images may be printed on it. The plastic may be non-transparent (using any color scheme).

[0077] For additional ventilation, the outer side of the frame in front of the mouth area may be a movable wall in the form of a membrane that can oscillate in sync with breathing.

[0078] The part of the frame that comes into contact with the surface of the face may be made from a solid fabric or net (fine- or coarse-meshed) out of cotton fabric, for example, or a transparent or semi-transparent natural fabric (e.g. silk, batiste, chiffon etc.), or a synthetic polymer (e.g. nylon, capron, etc.).

[0079] For greater strength and better adaptation to the surface of the face, components for shaping and reinforcing the mark (mesh, threads, elastic bands and straps, which act as ties for the mask, etc.) may pass between the layers of breathable material.

[0080] Due to the presence of frames in all versions of the masks, various devices and equipment can be installed in the channels thereof for the additional treatment of the air used in respiration (for cleaning, drying, disinfection, cooling, heating, deodorization, etc.).

[0081] By taking into account the different characteristics of air flows formed during inhalation/exhalation, via

oral or nasal breathing, the mask frame cavity may contain at least one device for the optimization and separation of the air flows, for example, one or multiple partitions, air channels, etc.

[0082] At least one filtration component may be installed along the air flow path in the frame channel, which can be further treated with an antiseptic agent, for example, or developed with a filtration material that is used in the manufacture of medical masks (for example, spunbond fabric).

[0083] In addition, at least one air channel within the mask frame may contain at least one moisture-absorbing element.

[0084] Any air channel within the mask frame may contain at least one inlet or outlet valve.

[0085] At least one tube for the forced supply of an air mixture to the respiratory organs from an external source and/or for the forced discharge of exhaled air from the under-mask space may be attached to at least one air channel within the mask frame.

[0086] At least one air channel within the mask frame may additionally contain at least one compressed air bottle to improve the composition of the inhaled air in standalone mode or in field (combat) conditions.

[0087] At least one air channel within the mask frame may also contain at least one fan.

[0088] At least one air channel may be made in the form of a spiral, which would make foreign particles in the inhaled air moving in a rotational (centrifugal) manner and settle on the channel's walls.

[0089] At least one air channel within the mask frame may contain at least one zero-resistance filter.

[0090] The inner surface of the frame channel may be treated with a special adhesive that promotes the superficial adhesion of dust and various biological aerosols contained in the air.

[0091] The mask frame may additionally be electrostatically treated to ensure the superficial precipitation of dust particles and other foreign particles contained in the passing air flow and possessing the opposite electrical potential.

Claims

1. A medical framed barrier and discharge face mask which is a hollow frame (2, 3) that forms an under-mask space in the facial area, the hollow frame consisting of two parts (2, 3) which form its outer side (2) and inner side (3); the hollow frame (2,3) is made in the form of at least one channel that contains the air inlet and outlet comprising lateral air holes (5) for the passage of the airflow, wherein the hollow frame forms the under-mask space for the lower part of the face, in addition, the outer side (2) of the frame is air-impermeable, and the side that comes into contact with the surface of the face (3) is made of breathable material; and wherein the hollow frame (2, 3) is configured such that in use the inner side (3) comes into contact with the surface of the face and air entering through lateral air holes (5) passes through the at least one channel.

2. A medical mask according to claim 1, wherein the side of the frame that comes into contact with the surface of the face (3) has a cutout (4) around the mouth.

3. A medical mask according to claim 1, wherein the breathable material (6) extends beyond the frame.

4. A medical mask according to claims 1 and 3, wherein at least one inlet and/or outlet contains an additional component (6) that directs exhaled air to the material that comes into contact with the surface of the face. The component extends beyond the frame.

5. A medical mask according to claim 3, wherein a breathable material (6) that extends beyond the frame contains an additional device (7) for retaining the moisture of the exhaled air.

6. A medical mask according to claim 1, wherein the outer side of the frame has folds in the form of corrugations or pleats.

7. A medical mask according to claim 1, containing at least one device (9) for fixing the mask to the head area.

8. A medical mask according to claim 1, wherein the side of the frame that comes into contact with the surface of the face (3) is hygroscopic.

9. A medical mask according to claim 1, wherein the outer side (2) of the frame is fully or partially transparent.

10. A medical framed barrier and discharge face mask which is a hollow frame (2, 3) that forms an under-mask space in the facial area, the hollow frame consisting of two parts (2, 3) which form its outer side (2) and inner side (3); and that is made in the form of at least one channel containing an air inlet and outlet comprising lateral air holes (5) for the passage of the airflow, wherein the frame (2, 3) additionally contains a shield (10), which, in use, closes off at least the lower part of the nose and which forms a partition (11) with the frame, the partition containing at least one air opening; wherein the hollow frame (2, 3) is configured such that in use the inner side (3) comes into contact with the surface of the face and air entering through lateral air holes (5) passes through the at least one channel.

11. A medical mask according to claim 10, wherein at

least one valve is present in at least one air opening.

12. A medical framed barrier and discharge face mask which is a hollow frame that forms an under-mask space in the facial area, the hollow frame consisting of two parts (2, 3) which form its outer side (2) and inner side (3); and that is made in the form of at least one channel containing an air inlet and outlet comprising lateral air holes (5) for the passage of the airflow, wherein the medical framed barrier and discharge face mask contains a shield (10) that is formed with the possibility for contact along the contour of the face around the dorsum nasi and which forms a partition (11) with the frame (2, 3), wherein the outer side of the frame, in the oral area, is air-impermeable, and the other part is made of filter material and, wherein the at least one channel has at least one device (14) that allows it to be closed.

13. The medical mask according to claim 12, wherein the shield is made of filter material (12).

Patentansprüche

1. Medizinische gerahmte Barriere- und Entladungs-Gesichtsmaske, die ein hohler Rahmen (2, 3) ist, der einen Raum unter der Maske in dem Gesichtsbereich bildet, wobei der hohle Rahmen aus zwei Teilen (2, 3) besteht, die seine Außenseite (2) und Innenseite (3) bilden; der hohle Rahmen (2, 3) in der Form mindestens eines Kanals gefertigt ist, der den Lufteinlass und -auslass enthält, die seitliche Luftlöcher (5) für die Passage des Luftstroms aufweisen, wobei der hohle Rahmen den Raum unter der Maske für den unteren Teil des Gesichts bildet, zusätzlich die Außenseite (2) des Rahmens luftundurchlässig ist und die Seite, die in Kontakt mit der Oberfläche des Gesichts (3) kommt, aus atmungsaktivem Material gefertigt ist; und wobei der hohle Rahmen (2, 3) derart konfiguriert ist, dass im Gebrauch die Innenseite (3) in Kontakt mit der Oberfläche des Gesichts kommt und Luft, die durch seitliche Luftlöcher (5) eintritt, durch den mindestens einen Kanal passiert.

2. Medizinische Maske gemäß Anspruch 1, wobei die Seite des Rahmens, die in Kontakt mit der Oberfläche des Gesichts (3) kommt, einen Ausschnitt (4) um den Mund herum hat.

3. Medizinische Maske gemäß Anspruch 1, wobei das atmungsaktive Material (6) sich über den Rahmen hinaus erstreckt.

4. Medizinische Maske gemäß Ansprüchen 1 und 3, wobei mindestens ein Einlass und/oder Auslass eine zusätzliche Komponente (6) enthält, die ausgeatmete Luft zu dem Material leitet, das in Kontakt mit der Oberfläche des Gesichts kommt, wobei sich die Komponente über den Rahmen hinaus erstreckt.

5. Medizinische Maske gemäß Anspruch 3, wobei ein atmungsaktives Material (6), das sich über den Rahmen hinaus erstreckt, eine zusätzliche Vorrichtung (7) zum Zurückhalten der Feuchtigkeit der ausgeatmeten Luft enthält.

6. Medizinische Maske gemäß Anspruch 1, wobei die Außenseite des Rahmens Bruchkanten in der Form von Wellen oder Falten aufweist.

7. Medizinische Maske gemäß Anspruch 1, die mindestens eine Vorrichtung (9) zum Fixieren der Maske am Kopfbereich enthält.

8. Medizinische Maske gemäß Anspruch 1, wobei die Seite des Rahmens, die in Kontakt mit der Oberfläche des Gesichts (3) kommt, hygroskopisch ist.

9. Medizinische Maske gemäß Anspruch 1, wobei die Außenseite (2) des Rahmens vollständig oder teilweise transparent ist.

10. Medizinische gerahmte Barriere- und Entladungs-Gesichtsmaske, die ein hohler Rahmen (2, 3) ist, der einen Raum unter der Maske in dem Gesichtsbereich bildet, wobei der hohle Rahmen aus zwei Teilen (2, 3) besteht, die seine Außenseite (2) und Innenseite (3) bilden; und der in der Form mindestens eines Kanals gefertigt ist, der einen Lufteinlass und -auslass enthält, die seitliche Luftlöcher (5) für die Passage des Luftstroms aufweisen, wobei der Rahmen (2, 3) zusätzlich einen Schild (10) enthält, der im Gebrauch mindestens den unteren Teil der Nase abschließt und der eine Partition (11) mit dem Rahmen bildet, wobei die Partition mindestens eine Luftöffnung enthält; wobei der hohle Rahmen (2, 3) derart konfiguriert ist, dass im Gebrauch die Innenseite (3) in Kontakt mit der Oberfläche des Gesichts kommt und Luft, die durch seitliche Luftlöcher (5) eintritt, durch den mindestens einen Kanal passiert.

11. Medizinische Maske gemäß Anspruch 10, wobei mindestens ein Ventil in mindestens einer Luftöffnung vorhanden ist.

12. Medizinische gerahmte Barriere- und Entladungs-Gesichtsmaske, die ein hohler Rahmen ist, der einen Raum unter der Maske in dem Gesichtsbereich bildet, wobei der hohle Rahmen aus zwei Teilen (2, 3) besteht, die seine Außenseite (2) und Innenseite (3) bilden; und der in der Form mindestens eines Kanals gefertigt ist, der einen Lufteinlass und -auslass enthält, die seitliche Luftlöcher (5) für den Durchgang des Luftstroms aufweisen, wobei die medizinische

gerahmte Barriere- und Entladungs-Gesichtsmaske einen Schild (10) enthält, der mit der Wahrscheinlichkeit für Kontakt entlang der Kontur des Gesichts um den Nasenrücken herum ausgebildet ist und der eine Partition (11) mit dem Rahmen (2, 3) bildet, wobei die Außenseite des Rahmens in dem Mundbereich luftundurchlässig ist und der andere Teil aus Filtermaterial gefertigt ist, und wobei der mindestens eine Kanal mindestens eine Vorrichtung (14) zum Verschließen hat.

13. Medizinische Maske gemäß Anspruch 12, wobei der Schild aus Filtermaterial (12) gefertigt ist.

Revendications

1. Un masque facial médical à barrière sur cadre et à décharge qui est un cadre creux (2, 3) qui forme un espace sous le masque dans la zone du visage, le cadre creux étant constitué de deux parties (2, 3) qui forment son côté externe (2) et son côté interne (3) ; le cadre creux (2, 3) est réalisé sous la forme d'au moins un canal contenant l'entrée et la sortie d'air comportant des trous d'air (5) latéraux pour le passage du flux d'air, dans lequel le cadre creux forme l'espace sous le masque pour la partie inférieure du visage, en outre, le côté externe (2) du cadre est imperméable à l'air, et le côté qui vient en contact avec la surface du visage (3) est réalisé en matériau respirant ; et dans lequel le cadre creux (2,3) est configuré de sorte que, en utilisation, le côté interne (3) vient en contact avec la surface du visage et l'air entrant à travers les trous d'air latéraux (5) passe à travers le au moins un canal.

2. Masque médical selon la revendication 1, dans lequel le côté du cadre qui entre en contact avec la surface du visage (3) a une découpe (4) autour de la bouche.

3. Masque médical selon la revendication 1, dans lequel le matériau respirant (6) s'étend au-delà du cadre.

4. Masque médical selon les revendications 1 et 3, dans lequel au moins une entrée et/ou une sortie contient un composant (6) supplémentaire qui dirige l'air expiré vers le matériau qui entre en contact avec la surface du visage. Le composant s'étend au-delà du cadre.

5. Masque médical selon la revendication 3, dans lequel un matériau respirant (6) qui s'étend au-delà du cadre contient un dispositif supplémentaire (7) pour retenir l'humidité de l'air expiré.

6. Masque médical selon la revendication 1, dans lequel la face externe du cadre présente des plis sous forme d'ondulations ou de plis.

7. Masque médical selon la revendication 1, contenant au moins un dispositif (9) pour la fixation du masque à la zone de la tête.

8. Masque facial selon la revendication 1, dans lequel le cadre qui vient en contact avec la surface du visage (3) est hygroscopique.

9. Masque facial selon la revendication 1, dans lequel le côté externe (2) du cadre est intégralement ou partiellement transparent.

10. Un masque facial médical à barrière sur cadre et à décharge qui est un cadre creux (2, 3) qui forme un espace sous le masque dans la zone du visage, le cadre creux étant constitué de deux parties (2, 3) qui forment son côté externe (2) et son côté interne (3) ; et qui est réalisé sous la forme d'au moins un canal contenant une entrée et une sortie comprenant des trous d'air latéraux (5) pour le passage du flux d'air, dans lequel le cadre (2, 3) contient en outre un bouclier (10), qui, en utilisation, ferme au moins la partie inférieure du nez et qui forme une partition (11) avec le cadre, la partition contenant au moins une ouverture d'air ; dans lequel le cadre creux (2,3) est configuré de sorte que, en utilisation, le côté interne (3) vient en contact avec la surface du visage et que l'air entrant à travers les trous d'air latéraux (5) passe à travers le au moins un autre canal.

11. Masque médical selon la revendication 10, dans lequel au moins une valve est présente dans au moins une ouverture d'air.

12. Un masque facial médical à barrière sur cadre et à décharge qui est un cadre creux (2, 3) qui forme un espace sous le masque dans la zone du visage, le cadre creux étant constitué de deux parties (2, 3) qui forment son côté externe (2) et son côté interne (3) ; et qui est réalisé sous la forme d'au moins un canal contenant une entrée et une sortie comprenant des trous d'air latéraux (5) pour le passage du flux d'air, dans lequel le masque facial médical à barrière sur cadre et à décharge contient un bouclier (10), qui est formé avec la possibilité de contact le long du contour du visage autour du dorsum nasi et qui forme une partition (11) avec le cadre (2, 3), dans lequel le côté externe du cadre, dans la zone buccale, est imperméable à l'air, et l'autre partie est réalisée en matériau filtrant et, dans lequel le au moins un canal a au moins un dispositif (14) qui lui permet d'être fermé.

13. Masque médical selon la revendication 12, dans lequel l'écran est réalisé dans un matériau filtrant (12). 1

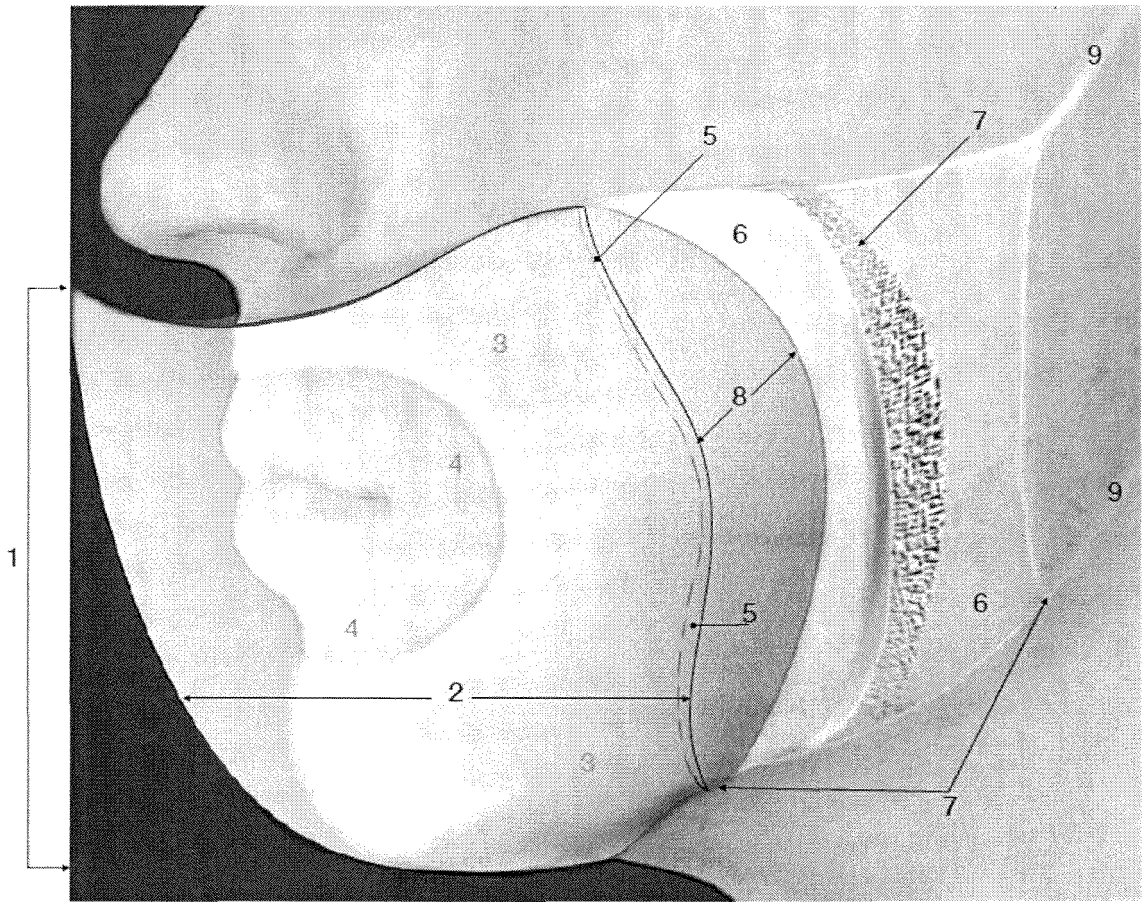

FIG. 1

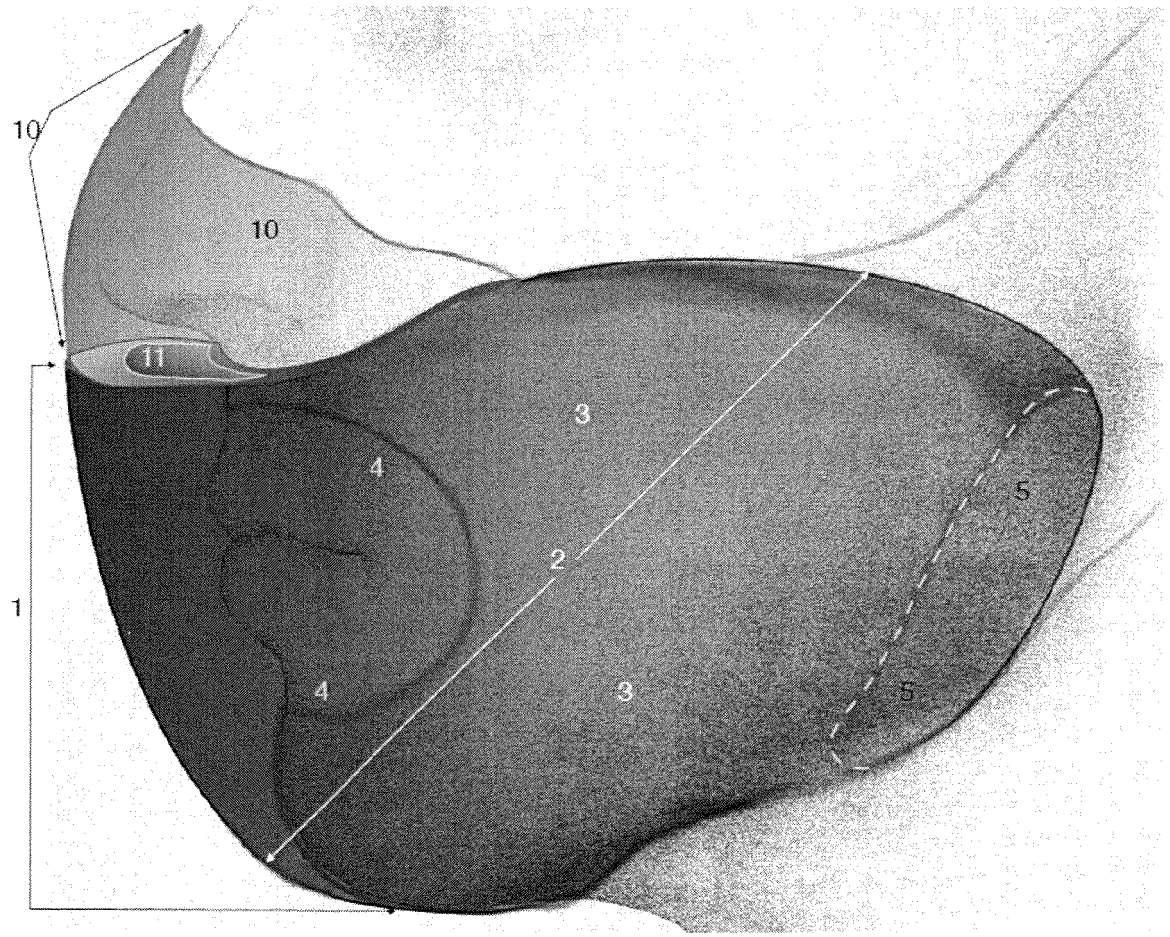

FIG. 2

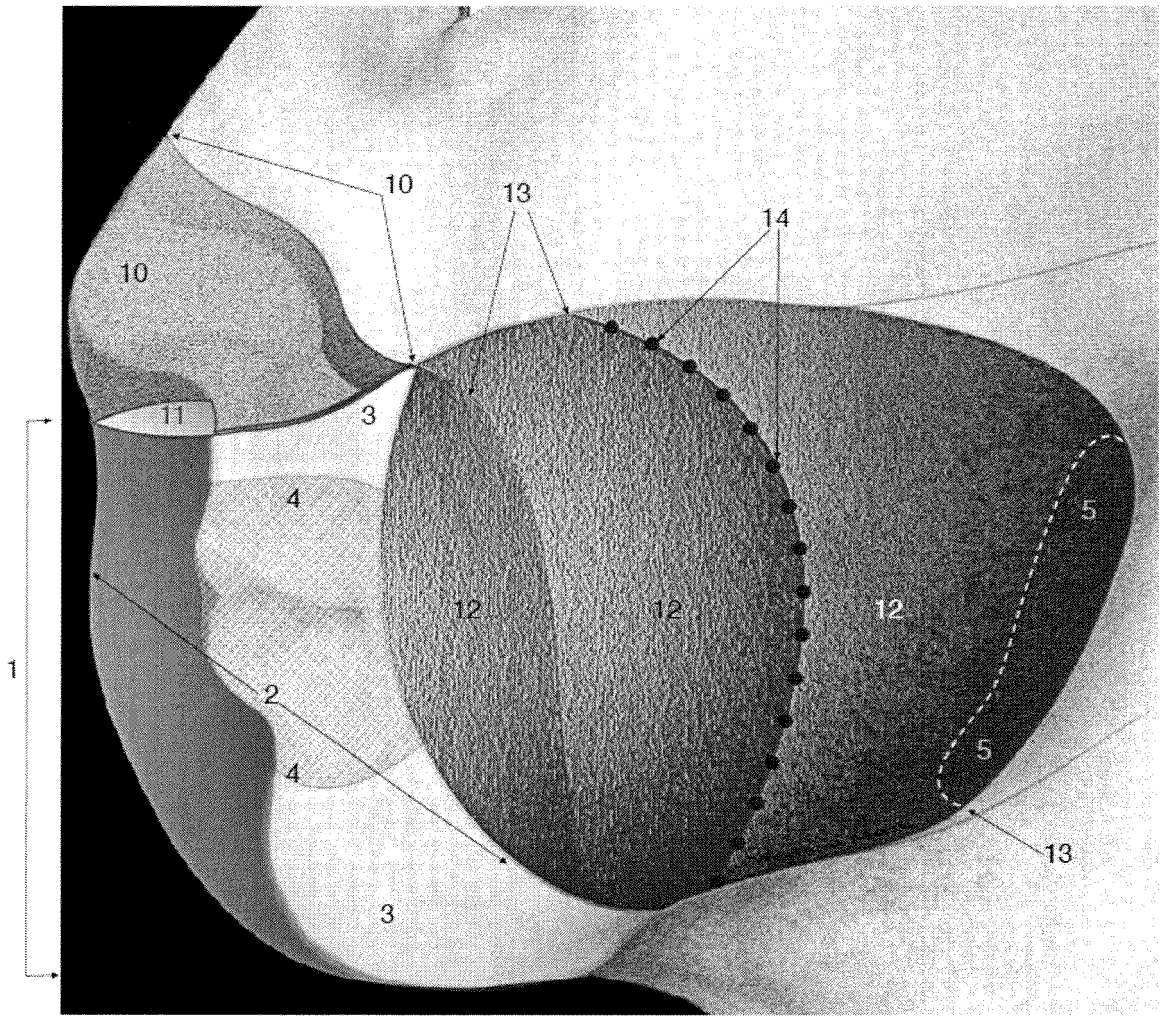

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 2162260 Y **[0009]**
- RU 2240160 **[0013]**
- JP 2005185381 A **[0017]**