ABSTRACT: A face piece for a protective mask is made from a natural or synthetic rubber or a plastic material and has a solid sealing rib projecting from the inner side of the face piece to engage the wearer’s face. The width of the sealing rib in the plane of the face piece is larger than the projection of the rib from the inner side of the face piece, and the surface of the rib engaging the wearer’s face is profiled to approximately follow the shape of the skull by varying the thickness of the rib longitudinally and transversally thereof.
FACE PIECES FOR PROTECTIVE MASKS

Face pieces for protective masks must sealingly engage the wearer's face to make it impossible for the gas against which the wearer wishes to protect himself to penetrate into the space between the face and the face piece. To further the sealing action some kind of sealing means has been used hitherto, and this sealing means projects from the inner side of the face piece to engage the wearer's face. The sealing means can have the shape of a hose which is deformed to a varying extent, thereby taking up variations in the shape of the face. Use has also been made of sealing means in the form of a sealing lip or a solid sealing rib which in the use of the protective mask snugly engages the wearer's face by way of its elasticity. All these prior-art sealing means are based on the principle that the shape of the sealing means shall change as a function of the shape of the wearer's face. Also prior-art sealing means which are formed as a solid sealing rib whose width is greater than the distance they project from the face piece, are based on the principle that the sealing means shall change its shape as a function of the shape of the wearer's face.

It has been found that the sealing means of the prior-art face pieces do not ensure the requisite tightness when the protective masks are used as a protection against the modern nerve gases which are active in extremely low concentrations. At the tests which have been carried out by the Royal Swedish Civil Defense Board it has proved that the so-called adaptation leakage (i.e. the capability of the sealing means to prevent leakage into the protective mask) should be lower than 0.01 percent. This implies that the concentration of war gas in the interior of the mask by reason of unight fit must be at most one ten-thousandth of the war gas concentration outside the protective mask.

The object of the present invention is to provide a face piece of a configuration that will fulfill the above-mentioned requirements. The invention relates to a face piece for a protective mask which is formed by natural or synthetic rubber or plastic material and has a sealing rib projecting from the inner side of the face piece to engage the wearer's face, the width of said rib in the plane of the face piece being greater than the distance said rib projects from the inner side of the face piece, and said rib extends in an upward arc from the jaw-joints, forwardly of the ears and over the wearer's front, said rib being located between the edge of the face piece and one or more eye pieces or lenses of clear material. According to the invention, the sealing rib of said face piece shall be formed with varying thickness so that the side of the sealing rib which is turned towards the wearer's face will have a profile that approximately follows the shape of the skull.

For better elucidation, the invention will be more fully described in the following with reference to the accompanying drawings in which:

FIG. 1 is a rear view of a preferred embodiment of the face piece.

FIGS. 2-7 are sections on lines II—II, III—III, IV—IV, V—V, VI—VI and VII—VII, respectively, in FIG. 1.

In the illustrated embodiment the face piece of the protective mask has an eye piece or lens 11 common to both eyes and consisting of some clear plastic material, e.g. acryl glass. The lens is fastened to the face piece in some suitable manner; in the embodiment illustrated the lens is glued into a groove provided in the face piece. In addition, the face piece has a fastening device 12 for a protective filter (not shown) which is retained in the fastening device in some suitable manner. From the space of the fastening device rearwardly of the protective filter there extend two inlet passages 13 which open at the lower edge of the lens 11. From the inner side of the face piece extends a baffle 14 which in the use of the mask engages the wearer's face in a gastight manner in the region between the cheek bones and over the root of the nose. Together with the portions 15 of the face piece which engage the wearer's face in the region from the cheek bones over the cheeks and around the chin, said baffle 14 forms an inner mask which is thus integral with the face piece proper. Besides the face piece has two inhaling passages 16 which extend from the lower edge of the lens 11 in between the baffle 14 and the main portion of the face piece, each of said inhaling passages leading to an inhaling valve 17 which is fastened in a suitable manner to the inner side of the baffle 14. The face piece also has a fastening device 18 for an exhaling valve (not shown). Said valve is located at the lowermost portion beneath the wearer CHIN and IS ARRANGED SO AS TO ENSURE SELF-DRAINAGE.

In a known manner the face piece of the protective mask has five fastenings 19—23 for mask fastening straps which are not shown in the drawings. At the edge of the face piece there is provided a solid sealing rib 24 which projects from the inner side of the face piece to engage the wearer's face. The sealing rib 24 extends in an upward arc from the jaw-joints, forwardly of the ears and over the front and will thus be located between the edge of the face piece and the lens 11. As will appear from the drawings the width of said sealing rib in the plane of the face piece is greater than the distance it projects from the inner side of the face piece.

The sealing means according to the invention is based upon another principle than the prior-art deformable sealing means. The principle underlying the invention is that the skin and the flesh between the sealing rib and the skull shall be exploited as sealing means for attaining a fully satisfactory tightness of the engagement. This is realized by shaping the profile of the sealing rib in conformity with the shape of the skull. As will appear from FIG. 5, the sealing rib thus is higher at the edge closest to the lens 11 at a level with the temporal cavities of the skull which lie forwardly of the ears. By the term "temporal cavities" is understood the hollow portion of the squamous part (pars squamosa ossis temporalis) above the zygomatic process (processus zygomaticus) on each side of the skull. Moreover, as will appear from FIG. 3, the sealing rib at the edge closest to the lens 11 has a bulge conforming to the cavity in the frontal bone above the root of the nose. The contemplated cavity is that formed by the nasal portion (pars nasalis) of the broad curved portion (squama frontalis) of the frontal bone. It is also advantageous, if, as will appear from FIG. 4, the sealing rib at the edge remote from the lens 11 has a gentle outward bulge conforming to the arch of the broad curved portion (squama frontalis) of the frontal bone.

As will appear from FIG. 6, the sealing rib 24 has been made slightly higher at the edge closest to the lens 11 on a level with the articular process (processus articulares) of the lower jaw below the zygomatic process so that the unemployment is insured also at this point. Beneath this point of the sealing rib the said rib successively merges into a rib having the same height at both edges and successively diminishing in thickness. This is illustrated by the section shown in FIG. 7.

The difference in height between the two edges of the sealing rib suitably is as follows: 2 to 3 mm in the section of FIG. 3, 0.5 to 1 mm in the section of FIG. 4, 3.5 to 4.5 mm in the section of FIG. 5, and 0.5 to 1 mm in the section of FIG. 6. There is no difference in height in the section shown in FIG. 7.

Of the above-mentioned outward bulges provided on the sealing rib 24 those at the temporal cavities are the most important for obtaining a satisfactory tightness of engagement. The bulge at the frontal bone cavity is not always necessary, for it is very well possible to arrange the sealing rib at a higher level at the wearer's front where there is no cavity in the frontal bone. However, the sealing rib is preferably placed just above the eyebrows since this will make the space between the face piece and the face smaller.

Experiments have shown that a face piece which is designed in accordance with the present invention provides a fully satisfactory seal against the faces of various individuals although the shape of the face varies from individual to individual. The explanation is — as more thorough investigations have shown — that the shape of the skull, specifically the location of the said temporal and frontal bone cavities differs only insignificantly from individual to individual although the outer contours of the face may vary greatly. The differences, if any,
between the shapes of the skulls of different individuals is equalized on the one hand by the face piece of elastic material being deformed when it is clamped to the face and on the other hand by the sealing rib moving aside the skin and the flesh which will thereby serve as sealing means between the face and the face piece. It should be mentioned, however, that—as is the case with all previously known face pieces—the intention of course is to manufacture the face piece of the present invention in several sizes to permit the selection of a face piece of a suitable size with due consideration of the size of the skull.

I claim:

1. A face mask made of a material from the group consisting of natural rubber, synthetic rubber and plastic materials, said face mask having an inlet for a clean inhaling gaseous medium, fastening means for inhaling and exhaling values and for mask fastening straps, at least one eye lens of clear material, a solid sealing rib on the inner side of the mask and projecting therefrom, said sealing rib having a larger width in the plane of the mask than the thickness of the projection of said rib from the inner side of the mask, a sealing surface on said sealing rib to engage the wearer’s face, said sealing rib extending in an upward arc from a point below the midpoint on each side of the mask and being located between the edge of the mask and said lens, a first bulge on said sealing rib at the edge thereof closest to said lens from a point just above the midpoint on each side of the mask, and a second bulge on said sealing rib at the edge thereof closest to said lens at the uppermost point of said sealing rib, said sealing surface being profiled, by varying the thickness of said rib, within the extent of said first and second bulges, to approximately follow the shape of the wearer’s skull, said first and second bulge being of sufficient rigidity so as to be capable of being pressed tightly against the skull to deform the skin and flesh therebetween and exploit them as sealing means.

2. The mask of claim 1 further having two outward bulges on said sealing rib at the edge thereof remote from said lens, said outward bulges approximately conforming to the arch of the broad curved portion of the frontal bone.

3. The mask of claim 1 further having an outward bulge on said sealing rib at the edge thereof closest to the lens on a level with each of the articular processes of the lower jaw beneath the zygomatic process of the skull.

4. The mask as defined in claim 1 wherein said mask includes means disposed below said eye lens for attaching said mask to a protective filter and permitting filtered air to enter said mask and at least one inlet passage connected to said means and extending therefrom toward said eye lens to enable all inhaled filtered air entering said mask to pass over the inner surface of said eye lens.

5. The mask as defined in claim 4 further having an inner mask integral with the mask and defined by a baffle extending from the inner side of the mask below said eye lens to engage the wearer’s face from the jaw-joints to and over the nose.

6. The mask as defined in claim 5 wherein said baffle is provided with at least one inhaling valve disposed therein, at least one inhaling passage communicating between said inhaling valve and the interior of the mask to permit filtered air which has passed over said eye lens to be inhaled by the wearer of the mask, and an outlet means in said mask for permitting passage of exhaled air to the atmosphere.