Jan. 7, 1941. N. SCHWARTZ 2,228,218

RESPIRATOR

Filed Nov. 25, 1936

Fig. 1.

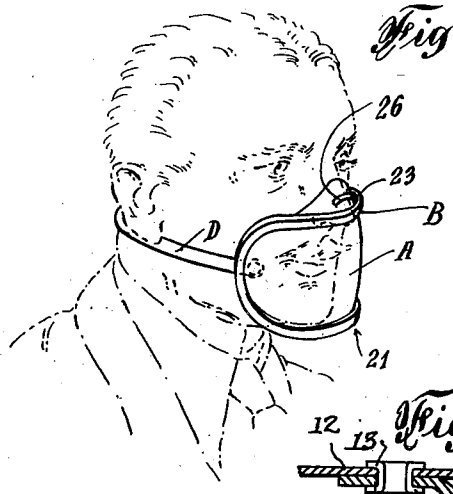


Fig. 2.

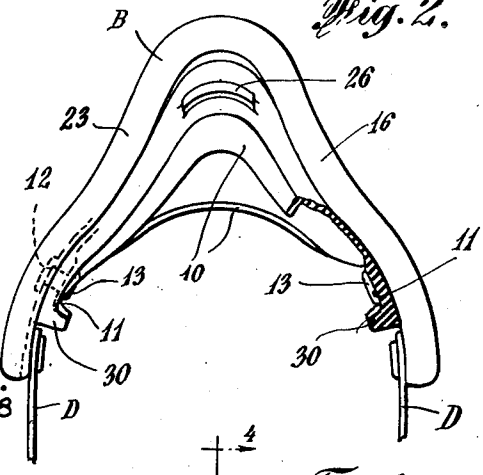


Fig. 10.

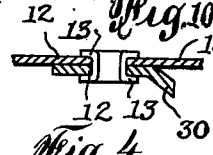


Fig. 4.

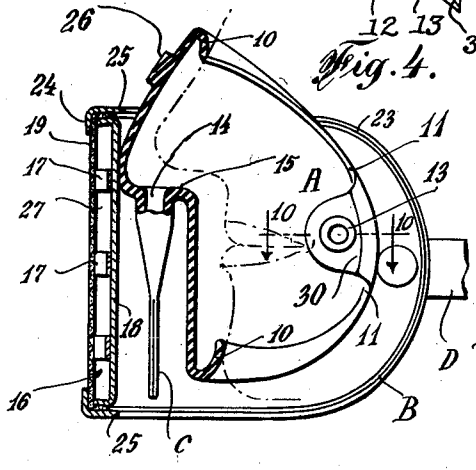


Fig. 3.

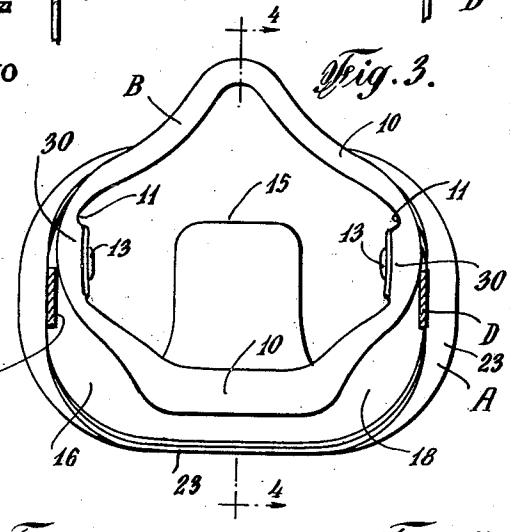


Fig. 7.

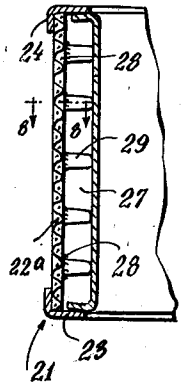


Fig. 8.

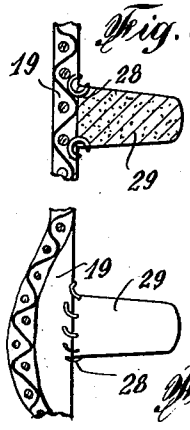
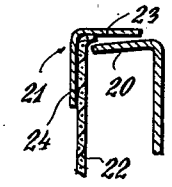


Fig. 9.

Fig. 6.

Fig. 5.



INVENTOR

Nathan Schwartz

Patented Jan. 7, 1941 2,228,218

UNITED STATES PATENT OFFICE

2,228,218

RESPIRATOR

Nathan Schwartz, New York, N. Y., assignor to Hygeia Filtering Corporation, New York, N. Y.

Application November 25, 1936, Serial No. 112,646

9 Claims. (Cl. 128—146)

This invention relates to filter type respirators adapted to cover the nose and mouth of the wearer for the purpose of protection against dust fumes and injurious gases and is a modification of my copending application for Letters Patent No. 2,112,213, filing date December 3, 1935, and my copending application Serial No. 110,557, filing date Nov. 13, 1936, and my Letters Patents 2,035,097 and 2,055,853.

The invention broadly aims to provide a respirator of minimum size and weight while affording a maximum area of filtration and also to minimize the reinhalation of exhaled air and also to facilitate the replacement of filter material and also to provide a comfortable and air tight face piece.

More particularly the invention resides in a molded cup shaped semiflexible elastic rubber face piece or its equivalent which has a marginal flange for engaging the face of the wearer and a filter unit is provided which has a substantially rigid base and the said filter unit is connected with the face piece by means of registering foramina and eyelet joints. The head band is secured to the rear side of the substantially rigid wall of the filter unit and is fastened at the back of the neck and thereby compression occurs at the face engaging part which causes an air-tight fit.

Another feature is to permit the use of several grades of filter material. That is, soft, stiff and semi-stiff filter fabrics are made practical for fitting at the marginal portion of the wall of the filter unit. Recent high standards of requirement in efficiency of filtration demands suitable and convenient methods of emplacement of the improved filter fabrics which have been and are being introduced for respirator use. Further explanations will be made later on in the specification.

Another object is to reduce the weight of the respirator by providing spacing means for the filter material by attaching fabric pieces at the inner side of the filter fabric instead of attaching rib elevations at the anterior side of the wall of the casing. This method is particularly adaptable and practical with the recently improved filter fabric material which is at present giving a high standard of efficiency. Namely the improved filter fabric is stiffened in the processing of its texture for the purpose of obtaining an increased filtering efficiency. Therefore due to the said stiffened texture of the filter fabric, small pieces of fabric material are attached to the inner side of the said filter fabric. Another advantage that is obtained by this improved spacing method is cleanliness. It is apparent that the possible collections of dust or other extraneous undesirable matter about the spacing extrusions are definitely avoided.

With the above recited and other objects in view, reference is had to the following description and accompanying drawing in which there is exhibited an example or embodiment of the invention while the claims define the actual scope of the same.

In the drawing:

Figure 1 is a perspective view of the improved respirator in applied position.

Figure 2 is a top view of the respirator illustrating the relations of the face piece, filter unit and head band, and a broken side section shows the arrangement of cheek flange.

Figure 3 is a rear view of the respirator, showing the positions of the molded elastic cup shaped face piece and the filter unit.

Figure 4 is a section of 4—4 of Figure 3.

Figure 5 is an enlarged detailed view of the marginal section of the filter unit, illustrating the collar fastener.

Figure 6 is a perspective view of the collar fastening device.

Figure 7 is a modified form of the filter unit and illustrates a stiffened filter fabric having no bend at the marginal section and having teats at its inner side.

Figure 8 is a section at 8—8 of Figure 7 and illustrates the attachment of the spacing teat.

Figure 9 illustrates the stitches for attaching the spacing teats to the filter fabric.

Figure 10 is a section on line 10—10 of Figure 4.

Referring to the drawing by characters of reference, A designates the face piece of the respirator, B designates the filter unit, C the valve and D the head band.

The face piece A, of the respirator is constructed of molded elastic semi-flexible and resilient rubber or its equivalent and is substantially cup shaped to fit at the nose, chin and cheeks of the wearer. The marginal engaging section of the said face piece has an inwardly directed flange 10 which flange 10 compressingly engages the face of the wearer. The said flange 10 is thickened at the sides 11 for engaging the cheeks and an extra amount of thickening is required at the side of the face piece 30. The reason for the altered requirement is that the musculatures which are present at the cheek portion require a

greater and firmer compression than that required at the nose and mouth. The face piece A is connected to the substantially rigid filter unit casing by means of registering holes 12, and by means of eyelet fasteners 13. The valve C is connected with the face piece at a recess portion below the horizontal nose line by means of an opening provided in the horizontal wall 15 for a tubular connection with the said exhaust valve.

This invention has two forms of filter units. The first form is illustrated in Figure 4. The casing 16 is substantially rigid and is connected with the rubber face piece preferably laterally by means of registering holes 12 and eyelets 13. The casing 16 has corrugated strips of metal 17 disposed at its inner side for the purpose of providing an air space between the said casing wall 18 and the filter material 19. The marginal flange 20 of the casing is directed outward and is inclined at an acute angle with reference to the wall 18. The collar fastener 21 is L sectioned and conforms to the shape of the marginal flange 20 and when in applied position fits snugly and embraces the filter material 19. The said collar has an outer arm 23 for clamping the flange 20 and has an inturned arm 24 for impinging on the filter material 19. The arm 23 of the collar fastener is straight and therefore readily engages the flange 20 of the casing 16, but as the said arm 23 slips over the flange 20 a wedging process occurs and a tight fit results. The arm 23 is slightly longer than the flange 20 and therefore when it is required to remove the collar 21 for certain reasons, such as, when replacement of filter material is necessary, the said length aids in the disconnecting process. Namely, due to the said extra length of the arm 23 there is an extension 25 of the said collar. The said extension is rearward of the casing wall 18, and if disconnecting is required, the said extension 25 is tapped against a solid material and readily loosens, or a solid material is tapped against the said extension with the same easy disconnecting result.

In the first form of this invention the casing 16 of the filter unit is substantially rigid and is preferably made of aluminum or its equivalent and the said casing has attached at the inner side of the wall 18 corrugated strips 17 for the purpose of providing an air space 27 between the wall 18 and the filter material 22. Also in this form the filter material fabric is preferably of soft texture and its edge extends slightly beyond the marginal end of the flange 20 of the casing 16, and the said filter material reaches the outer arm 23 of the collar fastener 21 and as the said collar fastener 21 is slipped over the flange 20, the said edge of the filter material is flexed and impinged over the flange 20, as shown in Figure 4. In Figure 5 the said filter material is shown prior to its complete flexion.

In the second form of this invention the casing 16 is the same as in the first form. The difference is that it is adapted for stiff filter fabric material 22*a* and therefore a variation in its adaptation is provided. Namely the size of the filter material 22*a* is to approximate the size of the flange 20 and therefore there is no flexion of its edge such as there is in the first form. Due to the thickness and also the stiffness of the filter material 22*a* it would be impractical to cause any flexion at the connecting margin. In Figure 7 the said connecting margin is illustrated. Otherwise the collar arrangement for fastening and securing the filter material 22*a* is the same as was in the first form. Also in the second form of this invention the corrugated spacing element 17 is dispensed with entirely and the air space 27 is here provided by stitching fabric material 29 onto the inner side of the filter material 22*a* which fabric material forms teats 29. In the drawing the said stitches are designated by the numeral 28.

In Figures 3 and 4 the flange arrangement at the face piece is clearly illustrated. It is to be noted that at the chin and also at the nose sections the flanges are comparatively thin and that they are disposed at an acute angle with its base of attachment, namely the body of the face piece. It is also to be noticed that at the sides, namely at the cheek sections of the face piece 30 and also at the side flanges 11 there is a thickening of the material and the flanges are disposed at right angles with relation to the face piece. When the side flanges 11 engage the face of the wearer, the said flanges are at right angles to the face.

It is to be noted that the head band is attached to the posterior side of the wall 18 of the casing 16 and the said wall is also connected by means of registering holes 12 to the face piece A. Therefore when the head band is fastened to the back of the neck of the wearer and the face piece A is thereby drawn backward, the nose and chin flanges become actively engaged in tightening against the nose and chin and the acute angle formations of the flanges become more acute and the angle may become obliterated if the compression is great enough. Also note that the right angle formation of the flange 11 at the cheek portion is also pressed in a forward direction, because the face piece is drawn rearward and therefore an acute angle is formed at the side flanges both in relation to the face piece and the face of the wearer. This arrangement is of special value because the cheek is muscular and must contact a substantial thick right angle flange, while the nose and chin parts are sensitive and should contact with a non-irritating material, which is arranged in a definite manner whereby there is a definite yield at the time of compression. The said yield therefore provides a comfortable and at the same time an effective nose and chin engagement with the said flanges 10. As stated the cheek portion of the face is not as sensitive to pressure as the chin and nose parts and therefore the right angle flange at the cheek part is thick for the reason that only little yield or none is necessary. However what is obtained is a slight yield and a slight inclination of the flange 11 to form an acute angle. It may be stated that the part 30 of the face piece A in the region of the cheek engaging part also needs to be substantially thick so that it does not yield readily to pressure.

As a further means of safeguard for preventing any dislocations at the flange engaging sections of the face piece A an additional strip of material 26 is added in a spanning position transversely and preferably at the outer side of the face piece A. The said strip 26 is preferably integral with the face piece A, but may be adhesively attached thereto, that is a semi-flexible strip of rubber may be placed in such a transverse spanning position.

What is claimed is:

1. In a respirator, a body portion having an inlet port, a filter unit having a wall with an anterior convexity and an eccentric aperture, and a filter pad having elevations, the said pad being mounted in confronting relation to the said wall over the said aperture and is spaced from the

said wall by the said elevations, and the configuration of the said pad is similar to the said wall, and the said aperture and inlet port register with one another in a manner whereby the said unit is adjacent to the said body portion.

2. A respirator having a body portion with an inlet port, a filter unit having a wall with an eccentric aperture, filter material and means for securing the said material at the marginal portion of the said wall comprising a forwardly directed flange located at the margin of the said wall and a substantially L-sectioned displaceable rim fastener overlapping the said flange and embracing upon the edges of the said material whereby the said material is secured thereat, and one of the arms of the said L extends rearward beyond the said wall whereby the rear end of the said arm may be tapped upon and thereby displaced, and the said aperture is connected with the said inlet port whereby communication is established between the said unit and the said body portion.

3. A respirator having a hollow mask body connected with a filter unit which has at least one wall with an anterior convexity and filter material of a similar configuration, and the said wall has an outwardly directed marginal flange and the filter material is removably secured at the said marginal flange by means of a displaceable collar fastener consisting of an L-sectioned rim which rim embraces the filter material at the outer portion of the said flange, when the said rim is in applied position, the rear edge of the said rim extending beyond the said wall which makes it possible to easily remove the said rim fastener by tapping upon the said rear edge.

4. In a respirator, a body portion having an inlet port, a filter unit having a wall with an eccentric aperture, filter material and means for securing the said material at the marginal portion of the said wall comprising a substantially L-sectioned marginal rim embracing upon the edges of the said material and thereby securing the said edges to the marginal portion of the said wall and the said wall has an anterior convexity and the said material is of a similar configuration, and the said material confronts the said wall and the said material has porous corrugations which corrugations provide means to space the material from the wall and also provide a larger inner surface filter area whereby breathing is made easier, and the said aperture connects with the said inlet port, whereby communication is established between the said unit and the said body portion.

4. In a respirator, a face piece having an inlet port, a filter unit having a wall with an aperture, and a filter pad having elevations, the said pad being mounted over the said aperture in parallel and confronting relation to the said wall, and spaced from the said wall by means of the said elevations, whereby a large internal surface area is provided for the pad, making easier breathing for the wearer, and the said port and aperture register with one another in a manner whereby the said unit is adjacent to the said face piece.

6. In a respirator, a face piece having an inlet port, a filter unit having a wall with an aperture, a filter pad having elevations, and means provided to removably secure the said pad at its edges to the marginal portion of the said wall, in a manner whereby the said corrugations confront the said wall and provide a spacing for the pad, and the said elevations are of filter material substance whereby a large filter surface area is provided and resistance to breathing is thereby diminished, and the said port and aperture register with one another in a manner whereby the said unit is adjacent the said face piece.

7. In a respirator, a face piece connected with a filter unit having a wall, filter pad with spacing teats, and the said teats are of porous material and attached to the said pad at its inner surface, and means provided whereby the said pad is mounted in confronting relation to the said wall in a manner whereby the edges of the pad are removably secured to the marginal portion of the wall and the said teats cause the said pad to be spaced from the said wall, thereby creating a large internal surface filter area whereby breathing is made comparatively easy.

8. A respirator having a body portion connected with a filter unit having filter material, an independent L-sectioned marginal clamping means, and a wall with a marginal seat, the said material being removably secured at its edges at the said seat in a manner whereby the said clamping means embraces the edges of the said material with one arm of the L while the other arm extends beyond the said wall whereby the said extending arm may be tapped upon for the purpose of disengaging the clamping means and removing the filter material.

9. In a respirator a face piece having a set back portion below the nose line wherein is located an exhaust valve and having an inlet port, a filter holder having a wall with an aperture and a marginal seat, filter pad having elevations, and marginal clamping means, the said pad being mounted in parallel relation to the said wall by having its edges removably secured at the said marginal seat in a manner whereby the said clamping means embraces the said edges and thereby clamps the same against the said seat, and the said elevations are arranged to confront the said wall and thereby space the pad therefrom, and the said aperture registers with the said inlet port in a manner whereby the filter holder is located adjacent the said face piece.

NATHAN SCHWARTZ.

CERTIFICATE OF CORRECTION.

Patent No. 2,228,218. January 7, 1941.

NATHAN SCHWARTZ.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 11-12, claim 6, for the word "corrugations" read --elevations--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of April, A. D. 1941.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)