

May 21, 1940.

R. MONRO ET AL
GAS MASK FACEPIECE

2,201,198

Filed Feb. 24, 1938

2 Sheets-Sheet 1

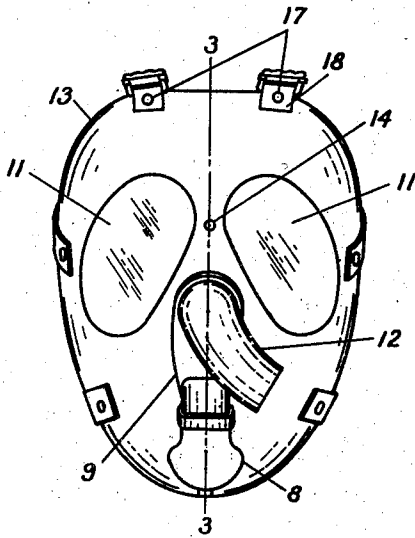


FIG. 1

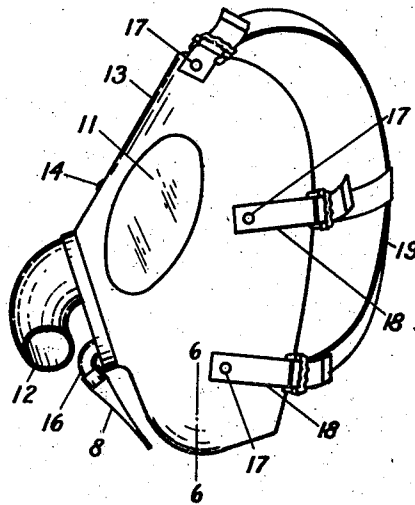


FIG. 2

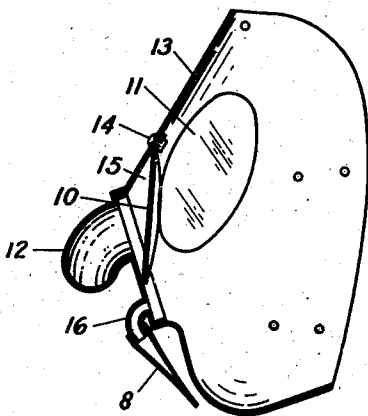


FIG. 3

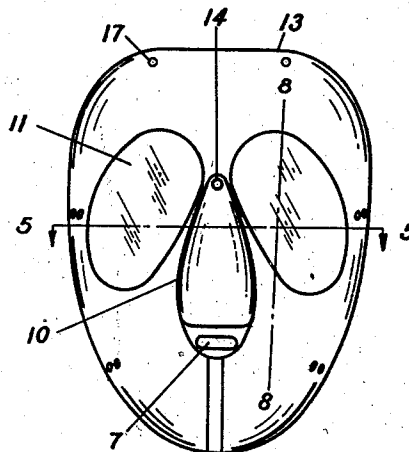


FIG. 4

INVENTORS
RANDOLPH MONRO
ARMAND V. MOTSINGER
HERBERT A. SCRUTON
GLENN A. LITTLE
BY

Millard F. Boake.
ATTORNEY

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2 Sheets-Sheet 2

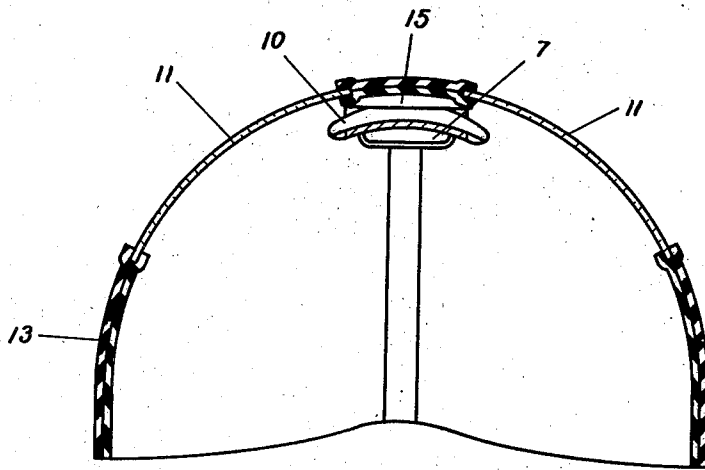


FIG. 5

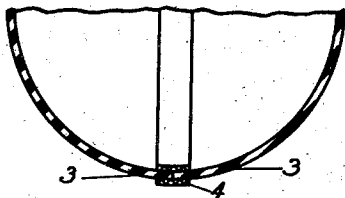


FIG. 6

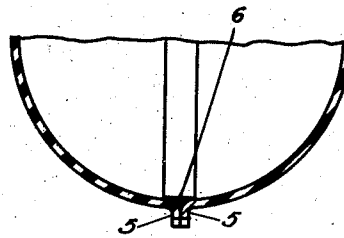


FIG. 7



FIG. 8

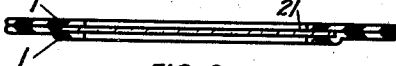


FIG. 9



FIG. 10

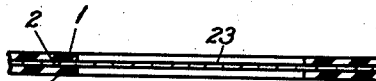


FIG. 11

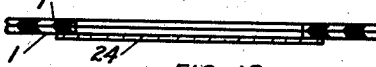


FIG. 12

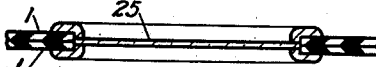


FIG. 13



FIG. 14

INVENTORS
RANDOLPH MONRO
ARMAND V. MOTSINGER
HERBERT A. SCRUTON
GLENN A. LITTLE

BY

Millard F. Beale

ATTORNEY

UNITED STATES PATENT OFFICE

2,201,198

GAS MASK FACEPIECE

Randolph Monro, Edgewood Arsenal, Armand V. Motsinger, Aberdeen, Herbert A. Scruton, Baltimore, and Glenn A. Little, Edgewood Arsenal, Md.

Application February 24, 1938, Serial No. 192,316

5 Claims. (Cl. 128—141)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

5 This invention relates to a new and improved gas mask facepiece which is light in weight and comfortable to wear.

In order to prevent the passage of harmful vapors or gases through the gas mask facepiece, it has heretofore been common practice to fabricate these facepieces of heavy material such as rubber, rubberized cloth, or other fabrics rendered highly impermeable to harmful agents. Relatively thick lenses have been secured to these facepieces such as glass lenses secured by metal binding rings. While such facepieces have been successful in inhibiting penetration of harmful agents, they are expensive to manufacture and are very uncomfortable to wear due to their weight.

One object of this invention is to provide a gas mask facepiece which is highly impermeable to harmful gases and vapors and yet is simple and cheap to manufacture and is very light in weight.

25 Another object of the invention is to provide a gas mask facepiece having lenses curved to the facial contour, thus materially increasing the range of vision, the lenses being readily secured in place when the facepiece is made.

30 Another object of the invention is to provide a facepiece fabricated from plied materials permanently united together, with lenses secured in place between the plied materials.

Another object of the invention is to provide a facepiece having a simple lightweight deflector plate secured therein which serves to pass the inhaled air over the lenses and also provides a form to hold the lightweight material to the desired shape.

40 Another object of this invention is to provide a facepiece having eye lenses and faceblank containing similar materials so that a solvent for both will readily weld the materials together.

Another object of this invention is to provide a facepiece having eye lenses, faceblank, and cement containing compatible materials so that the eye lenses will weld to the faceblank material.

Another object of this invention is to provide a facepiece having eye lenses and faceblank made of thermoplastic materials and such that the two materials will weld when heat and pressure are applied.

These and various other objects of this invention will be apparent from the following description and claims, with the understanding that the

invention is not limited to the precise details herein given.

In the drawings:

Figures 1 and 2 are front and side elevations of the complete facepiece of a gas mask.

Figure 3 is a section 3—3 of Figure 1 showing the inside of the facepiece.

Figure 4 is a rear view looking into the facepiece with the head harness removed.

Figure 5 is a section 5—5 of Figure 4 showing the curvature of the eye lenses.

Figure 6 is a section 6—6 of Figure 2 showing the chin seam.

Figure 7 is a similar section showing a modified chin seam.

Figures 8, 9, 10, 11, 12, and 13 are sections 8—8 of Figure 4 showing modified lens mountings.

Figure 14 is an enlarged section of the facepiece materials separated.

In accordance with this invention, the facepiece material is made of one or more plies of flexible material to provide mechanical strength and gas protection. If it is desired to increase the length of time of impermeability to gases, two plies may be used, or may be used and combined with a layer of material highly impermeable to gases and vapors. The impermeable layer may be thermoplastic. It may be a gas-resistant material such as viscose fabric, drying oil composition, cellulose nitrate, cellulose acetate, or sheeted regenerated cellulose. Eye lenses made of cellulose acetate, cellulose nitrate or similar clear materials may be inserted as hereinafter described.

In the preferred form of this invention, the layers of stronger material are placed on each side of the thin sheet of highly impermeable material. The stronger materials may be cotton cloth, thin leather or leather substitutes, or other fibrous materials having the requisite mechanical strength and flexibility.

Preferably the outer materials are coated on their inner surfaces with a coating of such nature that a strong permanent seal may be obtained with the impermeable inner sheet by the application of solvents, cement or heat and pressure, to thus form in effect a unitary sheet. For example, excellent results have been obtained by coating cotton cloth of the outer ply 1, Figure 14, with cellulose acetate composition, or by using a commercial coated fabric having a cellulose acetate composition coating, then placing a thin sheet of cellulose acetate 2 between two sheets of the coated cotton cloth outer ply 1, with the coated sides facing inwardly, the coated sides being cov-

ered with a suitable adhesive which will readily combine and form a permanent seal with the coating and cellulose acetate inner sheet 2, then uniting the plies by passing through rolls under pressure and allowing the cement to dry through the outer layers. It is not necessary in all cases to coat the cloth of the outer ply 1, Figure 14, with the cellulose acetate composition, but the adhesive may be applied directly to the cloth and the assembly otherwise made as above. The number of plies of material used, the material selected, and arrangement of plies depends on the length of time the facepiece is to resist the penetration of gases.

It will be understood that the cement used should be selected in accordance with the particular impermeable sheet, lenses, and coatings used. The adhesive for cellulose acetate lenses, inner sheet and composition coating, for example, may contain cellulose acetate and an alkyl resin (a combined gum and plasticizer), equal parts, dissolved in a suitable solvent mixture such as ethyl alcohol 100 grams, ethyl acetate 200 grams, dioxan 300 grams, methyl cellulose 100 grams, ethyl lactate 100 grams, toluol 300 grams.

When thermoplastic materials are used that are inherently adhesive, additional cement may be omitted and the plies may be adhered by the application of heat and pressure. Cellulose nitrate lenses and cellulose nitrate coated fabrics have been used by this process to make faceblanks.

When materials are used that become adhesive by the application of a solvent the solvent may be used without additional cement and the material may be plied by the application of the solvent and pressure. An example of such materials are cellulose nitrate lenses and cellulose nitrate coated fabrics.

The highly impermeable ply of material is preferably adhered to one of the two outer plies before the outer plies are died out for assembly. The outer plies then have holes cut out for lenses and are adhered together with lens in place over the holes. The outer plies are adhered together and to the lenses by means of either the thermoplastic, solvent, or cement method described above. After this operation the plied material is cut to the proper shape so that the facepiece can be shaped to fit the face by a single seam along the chin portion, an opening being left in front of the wearer's mouth and nose for attachment of an angle tube. The general shape of the outer material prior to assembly is shown and described in U. S. patent to R. Monro, #1,395,759, dated November 1, 1921, but modified so that the angle tube may be placed and shaped to reinforce and hold the front of the facepiece to the desired shape.

In certain types of facepieces the impermeable inner sheet 2 does not have openings cut therein for the lenses, since this material, i. e., cellulose acetate, cellulose nitrate, or regenerated cellulose sheet, when assembled with the two outer sheets, may form the lenses 11 of the completed facepiece. By this one-piece construction of lenses 11 and inner sheet 2 there is no possibility of leakage between the facepiece and the lenses, as is the case with separately attached lenses, and the facepiece may be lighter in weight due to the thin inner sheet being used to form the eye lenses.

After the plies are firmly bonded together with eye lenses in place and the blank so formed cut to the proper shape as described, the facepiece is then completed by drawing the chin seam portions 3 (Figure 6) together to form the chin seam.

Preferably the chin seam is sewed and adhesive strips 4 (Figure 6) are placed along the inner and outer faces of the seam. These strips are coated with suitable compounds to permit adhesion to the faceblank by the application of solvents and pressure, or heat and pressure. In an alternate method two side portions 5 (Figure 7) are brought into surface contact and sewed together. Then the facepiece is opened to thus form a U-shaped groove which is filled with a suitable plastic 6 such as highly plasticized cellulose nitrate composition dissolved in suitable solvents.

Referring to Figures 1, 2, 3 and 4 it will be seen that the front of the mask makes a straight line from the forehead over the nose of the wearer. The top of the pressed metal angletube is at the lower end of this line and the depth is such that the exhalation port 7 is just in front of the mouth for drainage through this port and the flutter valve 8 of any moisture collecting inside the facepiece. The angletube body 9 is of such a shape to prevent distortion of the faceblank material in the front of the facepiece. It is secured by means of a clamp over the faceblank material in the opening provided for it in the facepiece. A deflector 10 is also shaped to hold the facepiece in the desired shape and to fit the inside curvature of the facepiece due to the eye lenses being curved. Air from a canister (not shown) enters the facepiece through the inlet tube 12 directly to the space 15 between the deflector 10 and faceblank 13 near the eye lenses 11. The top of the deflector is made narrow near the lenses 11 to form an entrance for the incoming air to pass over and clear the lenses 11. The bottom of the deflector is attached, for example by soldering, to the angletube just above the outlet port 7, and below the inlet tube 12. The top of the deflector is secured to the faceblank by means of a capped rivet 14. The inlet stem 12 preferably is turned to one side for an air hose and canister (not shown). The inlet stem 12 attached to the top of the angletube body 9 in order to have direct entry of the air near the eyepieces, thus providing low resistance and a simple assembly. Air is exhaled through the outlet port 7, outlet stem 16, and outlet flutter valve 8. The outlet valve slopes inwardly toward the chin portion where it is protected from injury.

Rivets 17 are positioned near the periphery of the mask for securing straps 18 to which a head harness 19 is connected. The two upper rivets 17 are placed directly above the centers of curvature of the lenses 11. Due to the curvature of the lenses, there is a tendency of the facepieces to bulge at the periphery above the lenses. By placing the upper rivets at these points of bulging, a tight fit of the mask is secured.

The eye lenses are large in order to provide good vision. They are curved as shown in Figure 5 to provide a good fit of the facepiece and maximum side vision.

Figures 6 and 7 show the chin seam as above disclosed.

Figure 8 shows a method of securing a lens made of cellulose acetate or similar material over the hole cut in a single layer of faceblank material 1. This material may be a cellulose acetate composition coated fabric as described above. The lens is adhered preferably to the coated side by a cement, solvent, or heat and pressure as above disclosed.

Figure 9 shows a lens 21 secured between two layers of coated fabric 1, which are plied, preferably, with coated surfaces facing the lens and adhered as above disclosed.

Figure 10 shows a lens 22 secured between plies as in Figure 9, except that the thin highly impermeable sheet such as cellulose acetate is fabricated between the outer plies to increase the degree of gas protection.

Figure 11 shows an eye lens 23 formed by the thin impermeable sheet 2 extending over the holes in the faceblank material 1.

Figure 12 shows a cellulose acetate lens 24 adhered to the outside of two plies of faceblank material 1 by one of the methods as above disclosed.

Figure 13 shows a cellulose acetate eye lens 25 cut to fit in the hold in the plied faceblank material 1. It is secured in place by molding plasticized cellulose acetate rings on either side of the lens-faceblank joint. Eye lenses have been secured in this manner by applying a cement as above disclosed, then molding the rings over the joint by a thermoplastic process.

Referring to Figures 8, 9, 10, and 12, in order to secure additional strength, it is sometimes preferable to sew the lenses in place after cementing. The stitches are passed through the overlapped edges of fabric and lenses and the small holes are then covered with a plastic cement.

The gas mask facepiece of this invention is very light in weight, is simply and cheaply made, and provides a wide angle of vision both vertically and horizontally. It is made for a substantially universal fit, that is, so that it will fit a large majority of adult faces, the arrangement of the attachment straps being such as to secure a gastight fit on most adult faces.

In the following claims the word "fabric" is intended to include cotton cloth, leather or imitation leather, or other fibrous sheet material of requisite strength and thickness.

It will be understood that the invention is not limited to the details of construction herein set forth by way of illustration, since changes and variations may be made therein by those skilled in the art without departing from the spirit of the invention nor exceeding the scope of the claims.

We claim:

1. The method of making gas mask facepieces which comprises coating a fabric with cellulose nitrate composition, assembling two sheets of the coated fabric on opposite sides of a sheet of cellulose acetate with the coated sides of the fabric contacting said sheet, permanently uniting the assembly by the application of heat and pressure, cutting the lens openings in the assembled sheets, placing lenses of relatively stiff cellulose acetate over said openings, sewing the lenses in place, and securing and sealing two edges of the assembly to form a chin seam for the facepiece.

2. The method of making gas mask facepieces which comprises coating a fabric with a layer of a material of the group consisting of cellulose nitrate, cellulose acetate and sheeted regenerated cellulose, assembling two sheets of the coated fabric on opposite sides of a gas impervious sheet of same material as the coating on the fabric with the coated sides of the fabric facing the sheet, subjecting this assembly simultaneously to heat and pressure to firmly unite the assembly, cutting the assembled fabrics and sheet to desired shape with two openings for eye lenses, and securing and sealing over said eye openings lenses of the same material as the coating.

3. The invention as defined in claim 2 wherein said lenses are thicker than said sheet, but are sufficiently flexible to conform to curvature of the face.

4. The invention as defined in claim 2, wherein the lenses are secured and sealed by slipping the lenses between the coated fabrics, sewing the lenses in place, and sealing the holes through which the sewing threads pass.

5. The invention as defined in claim 2, wherein the chin seam of the facepiece is formed by sewing together two overlapped portions, and filling the inside groove at the seam with plastic.

RANDOLPH MONRO.
HERBERT A. SCRUTON.
GLENN A. LITTLE.
ARMAND V. MOTSINGER.