FULLY MOLDED GAS MASK FACEPIECE

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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.

This invention relates to gas masks and an object of the invention is to improve generally upon gas masks as now known and used.

Among the objects of the invention are:

1. To increase the upward and downward angles of vision of the wearer; to provide adequate drainage for the facepiece; to provide an outlet valve and guard therefor, each characterized by simplicity of construction and efficiency of function; to provide a head harness of maximum comfort; to materially improve the manner of securing the straps of the head harness to the facepiece; to materially improve upon the gas seal between the facepiece and the face of the wearer; to insure against the objectionable turning inward of the edge of the facepiece against the face of the wearer incidental to the donning of the facepiece; to present a gas mask which as a complete unit will offer little if any interference with the proper use of the rifle or similar piece of firearms and to provide a facepiece of such structural characteristics that it may be vulcanized in a mold materially less complicated than the mold as is now generally required.

As will be appreciated as the description proceeds, the various components of the mask are so improved upon by the teachings of this invention that they combine to present a complete gas mask facepiece meeting all the exacting requirements of a gas mask that would be free of those objection characterizing prior gas masks and as known to those experienced in this art.

The invention, together with its objects and advantages, will be best understood from a study of the following description taken in connection with the accompanying drawings wherein:

Figure 1 is a front view of a gas mask embodying the features of this invention.

Figure 2 is a detailed sectional view substantially on the line 2-2 of Figure 4.

Figure 3 is a fragmentary detailed view, part in section and part in elevation, and taken substantially on the line 3-3 of Figure 4.

Figure 4 is a side elevational view of the gas mask with certain parts broken away and other parts shown in section.

Figure 5 is a fragmentary elevational view showing one manner of stitching the several straps of the harness together.

Figure 6 is a fragmentary side elevational view of the eyepiece assembly.

Figure 7 is a detailed sectional view illustrating the merging of the air channels with the connection for the inlet hole.

Figure 8 is a detailed sectional view showing a lens as initially positioned within the rim or flange forming part of an eyepiece of the mask.

Figure 9 is a view somewhat similar to Figure 8 but showing the lens in final and secured position.

Figure 10 is a sectional view through the assembled exhalation valve and guard therefor.

Figure 11 is a transverse sectional view through a valve seal and with the associated guard shown by broken lines.

Figure 12 is a perspective view of an exhalation valve forming a part of the invention.

Figure 13 is a fragmentary sectional view somewhat similar to Figure 8 and illustrating a slightly modified form of eyepiece flange or rim.

Referring more in detail to the drawings, 5 indicates generally the facepiece of the gas mask. This facepiece may be made of rubber or similar material molded or cast in one piece, and shaped to the contour of the human face. As illustrated, it extends beneath the chin, up the sides of the face and across the forehead; standing away from the nose and mouth as best seen in Figure 4, with the inlet for inspired air positioned just below the mouth of the wearer.

The aforementioned inlet, indicated by the reference numeral 6, is in the form of a cylindrical downwardly extending nipple integral with the facepiece. This inlet at its inner end merges with a pair of air passages 7-7 that extend upwardly from the inlet 6 and at opposite sides of exhalation chamber 8 to terminate at their respective ends in the region of the eyepieces indicated generally by the reference numerals 9-9. As is obvious, inspired air will pass upwardly through the passages 7 to impinge directly on the lenses 10 of the eyepieces and thus prevent concentration of moisture assuring the wearer of a clear vision.

The manner of providing the facepiece with the aforementioned air ducts 7-7 may be either by molding the air ducts with their front, sides and rear walls integral with the body of the faceblank, or, and preferably, only the front and side walls may be molded integral with the body of the faceblank, and the rear walls cemented or vulcanized subsequently in place.

In this connection it will be noted that as the seams around the rear walls are already within the confines of the facepiece, a leak in a seam will not affect the gastight integrity of the face-
piece. An advantage of this preferred construction and method of manufacture is that, as the cores of the air ducts are integral with the male portion of the mold and integral with the faceplate and by the elimination of long separate cores for the ducts. Attention is also called to the fact, and as clearly shown in Figures 1 and 4, that in accordance with this invention the air ducts 1—7 at the ends thereof opening in the vicinity of the outer faces 8 and 13 to cause the air insulated therefrom to effectively spread over the lenses. Also at these discharge ends the ducts 1 are curved to conform to the curvature of the eyespieces.

It may be observed that due to the width and curvature of the outlet ends of the air ducts as above explained there is a tendency of the tubes to collapse incidental to the application of eyewhings, hereinafter more fully referred to, in completing the assembly of the eyespieces. This tendency of the tubes to collapse may be effectively prevented by molding the material from which the tubes are made relatively thicker in the middle portions than at the sides thereof.

Herefore it has been the practice to make the port rimming each eyespiece port in the form of a rubber bead integral with the faceplate and a groove in the bead to receive the edge of the lens. At the junction of the bead and faceplate a recess is presented to receive a marginal edge of the metal binder or retaining ring. Such a structure as just described is objectionable because it requires a rather complicated mold for vulcanizing a faceblank so equipped. In accordance with this invention the wall 11 rimming each eye-port 12 projects outwardly from the body of the facepiece, is substantially of the same thickness as the facepiece body, and is free of all grooves and undercuts as shown in Figure 8. Positioned within the confines of the wall 11 is the lens or other transparency 10. In the present invention each lens is substantially of symmetrical triangular edge contour having rounded corners and of cylindrical curvature. The lens is made larger than the port so that when positioned within the confines of the port wall 11 as shown in Figure 8 the wall 11 will be strengthened as shown in Figure 9 and in a manner to form behind the lens 10 a continuous groove 13.

When in the position shown in Figure 9 the lens 10 is finally secured by resorting to a metal binder ring 14 that fits over the wall 11 as shown.

As shown in Figure 6 the ring 14 at one end is provided with an endless series of slits in a manner to form an endless series of spring fingers 15 that may be readily cramped into position and accommodated within the groove 13 as illustrated. Thus it will be seen that the ring may be readily applied in completing the eyespiece assembly.

By forming the walls 11 in the manner above explained, rapid manufacture of the facepiece is materially facilitated as the mold for casting the facepiece is simplified over the type of mold heretofore required.

Also, the assembly and construction lends itself to the use of lenses that are symmetrical and therefore interchangeable, and the lenses being elongated vertically, restriction of the wearer's upward and downward vision is materially minimized.

As an alternate form of construction, the wall rimming each eye-port may, as shown in Figure 76 13, be provided at its free edge with an integral abutment flange 112; the referred to wall being designated in this figure by the reference character 117.

In this alternate form of wall structure the flange 112 forms an abutment against which the lens is disposed incidental to final positioning of the lens. This alternate construction possesses all of the advantages of the wall structure shown in Figures 5 and 6 and as hereinabove enumerated.

The facepiece 6, in the region of the exhalation chamber 8 is provided with an exhalation port 15 rimmed by an outwardly projecting wall or flange 17.

For the port 16 there is provided an exhalation valve of the type shown to advantage in Figure 12. The type of exhalation valve herein illustrated is more or less well known to those experienced in this art and is very similar to that described in the patent to Max Yablack, No. 1,680,757, dated August 14, 1926. The exhalation valve 18 of this invention is, however, constructed with a departure from that shown in the aforementioned patent by having the tubular stem 19 thereof materially greater in length than the facepieces and for a purpose hereinafter made manifest.

Also in accordance with this invention there is provided for the valve 18 a novel form of valve seat 20 having a valve guard 21 associated therewith.

The seat 20 is in the form of a substantially flat plate 21 of metal, composition material, or any other suitable material, and is provided with a suitably positioned opening 23 rimmed by a tubular neck 24 that extends laterally from one side of the plate 22 and is accommodated within the confines of the port wall 17 as shown in Figure 10.

The valve 18 is associated with the seat 20 by passing the stem 19 of the valve through the neck 24 and then doubling back the free end portion of the stem 19 onto the neck 24 as clearly suggested in Figure 10.

With the valve stem 19 thus associated with the neck 24 the flexible wall 25 of the valve 18 seats against the body plate 22.

The valve 18 in seated position is effectively protected against damage through the medium of the aforementioned guard member 21.

The guard member 21 is in the form of a substantially concavo-convex plate of metal, composition material, or any other suitable material and is perforated as at 26 as shown.

Guard plate 21 for a portion of the length thereof has a marginal edge 27 that is transversely curved to complement spring fingers 28 of the neck 24 and then doubling back the free end portion of the stem 19 and is accommodated within the groove 18 as illustrated.

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As an alternate form of construction, the wall rimming each eye-port may, as shown in Figure 76
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In addition to effectively protecting the valve 18 against distortion during storage or injury in service, the guard plate is perforated as shown at their ends, to facilitate the transmission of the voice of the wearer through the valve. In this connection it may be observed that with a valve of the type herein shown and described, the sounds produced within the mask will cause the area of the valve wall 25A aligned with the stem 19 to vibrate and thereby amplify the sounds to a material extent and render audible sounds which otherwise could not be readily heard. It will thus be seen that the use of the guard 21 will in no wise detract from the sound amplifying qualities of the type of flutter valve. It will also be noted that the guard plate 21 is characterized by an absence of sharp edges or corners, the presence of which are objectionable as having a tendency to injure the hands of the wearer especially while firing a rifle. Consequently the guard assembly is readily secured in position on the gas mask by inserting the valve-stem encased neck 24 of the valve into the confines of the annular port wall 17. The wall 17 is then centered about the neck 24 by making two complete turns of wire 30 around the port wall 17 and securing the ends of the wire by twisting such ends together as suggested in Figure 4; the twisted ends of the wire being pressed into place parallel to the coil as shown in said figure. The wire 30 is then concealed by a band 31 of suitable material.

The harness by which the facepiece is maintained on the face of the user is fragmentarily illustrated, and in the present instance consists of three elastic straps that cross one another at the back of the user's head as suggested in Figure 5. The harness straps consist of two straps 32, 32 that at one end are connected at spaced intervals to the facepiece at the top of the latter; continue up through the neck 24 by making two complete turns of wire 30 around the port wall 17 and securing the ends of the wire by twisting such ends together as suggested in Figure 4; the twisted ends of the wire being pressed into place parallel to the coil as shown in said figure. The wire 30 is then concealed by a band 31 of suitable material. The harness strap, 33, extends, at an angle to the horizontal, from one side to the opposite side of the facepiece and is secured at its respective opposite ends to the facepiece above the points of attachment of the lower ends of straps 32, 32 with the facepiece as shown in Figure 4.

As shown in Figure 5 strap 33 crosses straps 32 at points spaced downwardly from the point of intersection of the latter straps. Where the straps cross they are stitched together; straps 32, 32 being secured to one another by stitching 34, and respectively secured to strap 33 by stitching 35.

While substantially diamond shaped stitching is illustrated, circular stitching may be resorted to; advantages of the latter pattern of stitching being the elimination of orientation of the harness under the needle of the sewing machine in accomplishing the stitching, and the resistance offered by three or more stitches to any strain on the straps that may tend to tear the stitching.

Identical stitching patterns, regardless of the selected pattern, should be used as such permits of the advantageous employment of an automatic sewing machine for the better accomplishment of the stitching operations.

Two important considerations in reference to gas masks are: the making of the joint between the edges of the facepiece and the face of the wearer gas-tight, and the provision of such a seal with minimum discomfort to the wearer.

In order to obtain a comfortable, gas-tight seal between the edges of the facepiece and the face of the wearer, the material of the facepiece at requisite places near the edges is thickened to afford integral, outwardly protruding bosses 30, 31. The lower ends of harness straps 32 are secured to the facepiece at the bosses 36, and the respective opposite ends of strap 33 are secured to the facepiece at the bosses 37 through the medium of rivets 38.

When the gas mask is in position on the user and tension is applied to the straps 32, 32, and 33, those portions of the facepiece in the regions of the bosses 36, 37 will be somewhat depressed or indented at the temple and cheek portions of the wearer. As a consequence the facepiece adapts itself to any facial contour and forms therewith a toxic gas and dust excluding seal.

In those instances where, as here, recourse is had to rivets for fastening the harness straps to the facepiece, prior practice was to make use of fabric reinforcements to prevent the rivets from pulling out. However, such reinforcement is unnecessary by reason of the type of rivet here employed, and characterized, as it is, by a concavo-convex head embodying an integral flange 39 and a cap plate 40 the edge of which is crimped over the edge of the flange as shown in Figures 2 and 3.

The diameter of the rivet head is such as to have considerable surface contact with the material of the facepiece, and when the rivet is driven home the head, as shown in Figure 4, is countersunk. As a consequence the material of the facepiece, such as for example, soft, pliable rubber, within the area of the rivet head is so confined by the latter that it is pressed or crowded toward the shank of the rivet and the rivet head grips the rubber in a manner to resist normal strain tending to dislodge the rivet.

As shown the rivet is passed through the material of the facepiece from the inner to the outer side of the latter, and the secured end of the harness strap is clamped between the boss and a washer 41 having a countersink receiving the upset end of the rivet shank.

It will also be noted that by having the rivet head countersunk or recessed into the material of the facepiece (Figure 2) the rivet is prevented from pressing against the face of the wearer. Hence the gas excluding seal between the edges of the facepiece and the face of the user is obtained without discomfort to the wearer.

The upper ends of harness straps 32, 32 are secured to tabs 42 by rivets 43 similar to rivets 38. In accordance with this invention, the rivets 43 are relatively thick as compared to the thickness of the material of the facepiece proper, and advantage is taken of the thickness of the tabs to recess or countersink the heads of the rivets into the undersides of the tabs as shown in Figure 3.

The securing of the harness straps to the facepiece either adjacent to the edges of the face-
piece or, as just described, to tabs extending from such edges is objectionable because by reason thereof the edges of the facepiece or of the tabs, as the case may be, are caused to press painfully against the head of the wearer. This objection is eliminated in the present instance by resort to substantially L-shaped washers 44 for the rivets 43. By resort to such washers arms 45 thereof overlie the free terminal edges of the tabs to substantially align the harness straps 32, 32, with the tabs as shown in Figure 3. As a consequence any tendency of the tabs 42 to turn inwardly and press against the forehead is effectively provided against.

The edge of the facepiece is restrained from being turned inwardly so as to hamper the rapid donning of the mask by the provision of integral loops 46 at the edges of the facepiece and through which the ends of the harness straps secured to the sides of the facepiece are trained (see Figures 2 and 4).

From the foregoing it will be appreciated by those experienced in this art that the various components of the mask are so improved upon as to combine in presenting a gas mask having good balance, improved seal—forming contact with the face of the user without irritation or causing discomfort, effective protection for the exhalation valve without detracting from the sound transmitting qualities of the latter or hampering access thereto for thawing or other purposes, affording a wider range of vision to the wearer, less likely to interfere with or hamper normal or required movements of the wearer in the use of firearms, and lending itself to greater mass production by requiring a mold considerably simplified over molds required in the production of prior art gas masks.

Having thus described the invention, what is claimed as new is:

1. In combination with a gas mask, an outlet valve comprising, a valve seat, a flutter valve in the form of a flattened bag of pliable material of greater area than said valve seat with a portion thereof extending beyond said valve seat, said flutter valve being slitted along the edge of said extending portion, a valve guard supported from and in front of said valve seat and substantially covering the flat projected area of said flutter valve, the portion of said valve guard covering said extending portion of the flutter valve being separated therefrom as so to thereby make said extending portion of said flutter valve free and accessible to be held between the thumb and fingers of the wearer of the gas mask.

2. In combination with a gas mask, an outlet valve comprising, a valve seat in the form of a flat plate with a neck extending therefrom, a flutter valve engaging said valve seat and in the form of a flattened bag of pliable material of greater area than the flat plate portion of said valve seat so that a portion thereof extends beyond said valve seat, said flutter valve being slitted along the edge of said extending portion and having an integral stem extending from the rear wall thereof of a length in excess of the length of said neck of said valve seat and adapted to be passed axially through said neck and then doubled back upon said neck for securing the assembly of said valve seat and flutter valve, a valve guard detachably mounted on and in front of said valve seat and substantially covering the flat projected area of said flutter valve, the portion of said valve guard covering said extending portion of the flutter valve being separated therefrom so as to thereby make said extending portion of said flutter valve free and accessible to be held between the thumb and fingers of the wearer of the gas mask.

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