Feb. 25, 1947. W. J. SHARBAUGH ET AL 2,416,411

FACE PIECE

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Fig. 2.

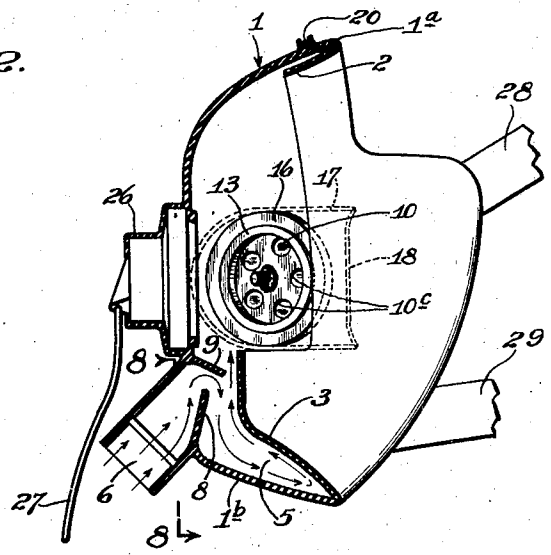
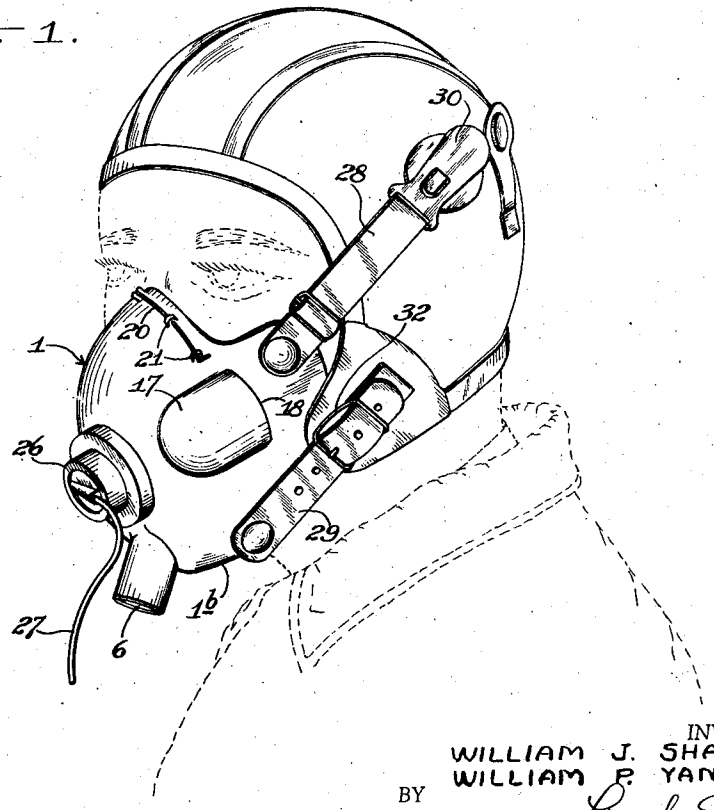


Fig. 1.



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Fig. 3.

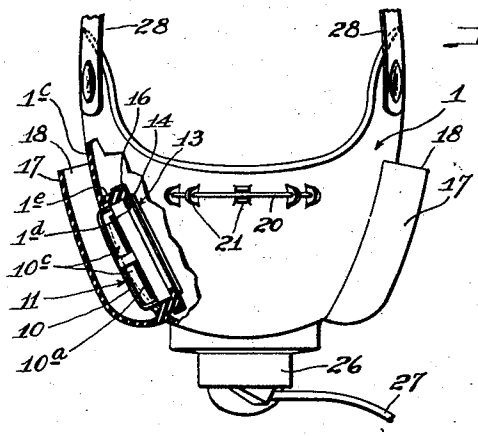


Fig. 7.

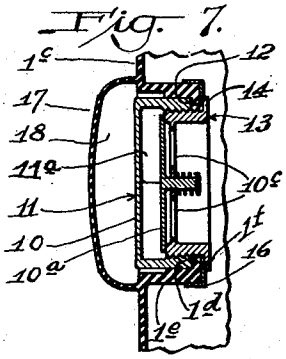


Fig. 4.

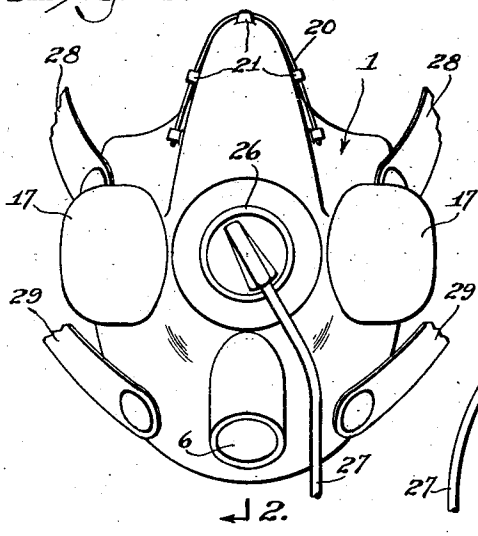


Fig. 5.

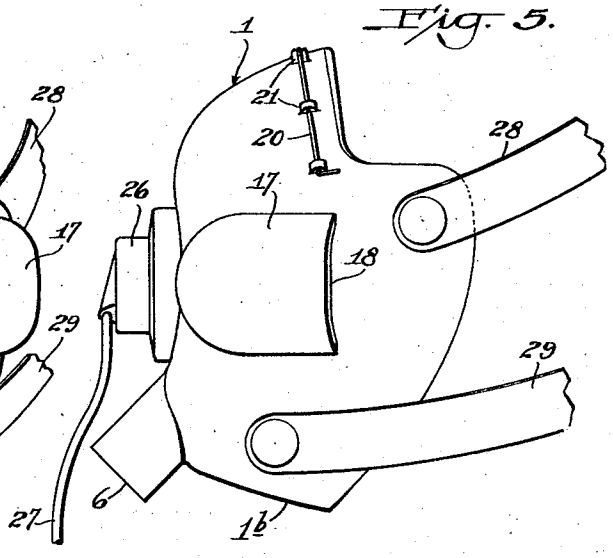


Fig. 6.

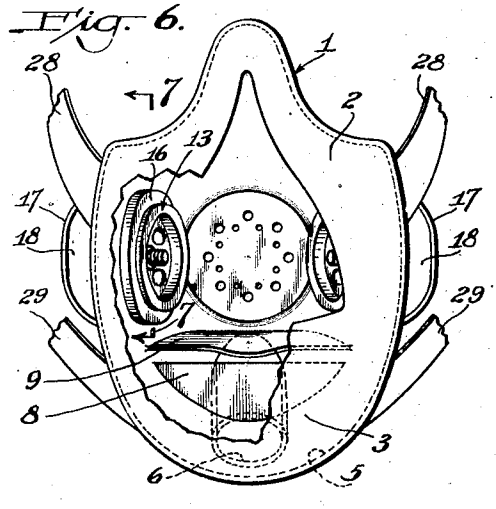
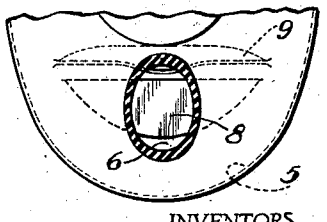


Fig. 8.



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UNITED STATES PATENT OFFICE

2,416,411

FACEPIECE

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Application April 10, 1942, Serial No. 438,378

4 Claims. (Cl. 128—146)

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This invention relates to an improvement in a facepiece used as a part of breathing apparatus, and more particularly, to a construction adaptable for use at low temperatures and constitutes an improvement of the facepiece as described in an application of William P. Yant for Letters Patent Serial No. 422,791, filed December 13, 1941.

The type of apparatus for which this facepiece is especially adaptable is the demand type of apparatus in which the facepiece is connected to a source of respirable air and in which is interposed a regulator responsive to the differences in pressure in the respiration cycle to control the flow of air to the facepiece and in which the air discharged in exhalation is eliminated from the facepiece by means of exhalation valves.

Since this type of apparatus is used at high altitudes and extremely low temperatures, considerable difficulty is had in preventing the exhalation valves from freezing because the exhaled air contains considerable moisture and rapidly condenses about the exhalation valve which freezes and prevents the functioning of the valve for controlling the discharging of air from the facepiece. Another factor of importance constituting a material disadvantage to the old constructions is that air passing into the facepiece from the supply is at such low temperature that it causes great discomfort and sometimes injury to the nasal passages and respiratory system.

It is among the objects of this invention to provide a facepiece arranged to enclose the nose and mouth from the atmosphere and having means operative to warm the respirable air entering the facepiece from the heat given off by the wearer, and which also includes a mounting, integral with the facepiece in each side portion, for an exhalation valve that protects the valve from being subjected to the extreme temperatures encountered and makes available heat within the facepiece for eliminating some freezing about the valve, and which is simple in construction and relatively inexpensive to manufacture.

Other objects of this invention will become apparent from a description of a preferred embodiment of the improvement which incorporates the principles of the invention and which is illustrated in the drawings, in which:

Fig. 1 is an elevational view of the preferred embodiment of the invention and illustrates the assembly of a facepiece incorporating the invention to an aviator's helmet;

Fig. 2 is a sectional view taken centrally of the facepiece along the line 2—2 of Fig. 4;

Fig. 3 is a top plan view of the facepiece partly in section illustrating the mounting of an exhalation valve to the improved facepiece;

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Figs. 4, 5 and 6 are front, side and rear elevational views, respectively, of the embodiment;

Fig. 7 is a sectional view of the exhalation valve taken along the lines 7—7 of Fig. 6; and

Fig. 8 is a sectional view taken along the line 8—8 of Fig. 2.

The facepiece 1 is made of a moldable material shaped to conform to the outlines of the face and sufficiently concave to accommodate the nose and mouth and to allow for a small chamber in front of the facepiece to operate as a breathing chamber. The facepiece 1 has connected to its inner periphery 1*a* a face engaging lip 2, preferably shaped to conform to the features of the face, which is extended to reduce the face opening of the concavity. The lip 2 usually carries some comfortable material which engages the face and is effective to seal the lip 2 and the facepiece material to the face. For example, chamois has been successfully used. This lip is usually contoured to conform as nearly as possible to the face and yet possess some yieldability so that its contour may be altered to conform to the differences in features of wearers as well as apply a slight sealing pressure to the face when worn to provide an adequate seal. The lip has a lower portion 3 that extends into the cavity toward the front of the facepiece and operates as a chin stop portion. As illustrated in Fig. 2, this portion 3 is arranged to be in spaced relation to the inner underside surface of the chin portion 1*b* of the facepiece. The portion 1*b* extends well under the chin toward the neck and forms an air chamber 5 in combination with the chin stop portion 3 of the lip. This chamber is used advantageously for supplying some heat from the wearer to the air entering the chamber before it is breathed. The lip material is, generally, not nearly as heavy as the material used in the body and is usually made of relatively thin, yieldable material readily effecting a seal with the face. Considerable heat is transmitted through the lip material from the wearer to the air within the chamber 5 as is the heat which is transmitted from other portions of the face. An inlet duct 6 connected to the source of respirable air is integrally molded to the facepiece and forms a part of the body.

In order to direct the flow of respirable air passing to the facepiece through the inlet duct 6 into this warming chamber 5 before flowing upwardly to the respiratory organs of the wearer, a system of baffles is provided. To accom-

plish this, a baffle 8, Figs. 2, 6 and 8 is provided which extends across the inlet duct in spaced relation to the juncture of the inlet tube and the facepiece and upwardly into the inner cavity of the facepiece. This baffle directs the air upwardly against another baffle 9 positioned with relation to the chamber 5 and the baffle 8 so that it receives the air directed upwardly by the baffle 8 and diverts it into the chamber 5. This baffle 9 is located at about the juncture of the inlet duct to the facepiece at its upper extremity, Fig. 2, and extends downwardly and somewhat rearwardly into the cavity of the facepiece to provide the directing face which engages the air forced upwardly in the duct by the baffle 8. Although air entering the facepiece from the duct 6 through the chamber 5 is not heated to a considerable extent, the amount of heat transferred is sufficient to measurably relieve the discomfort of breathing air direct from the inlet duct. The additional passage does not impose any appreciable resistance to the flow of air for breathing and, in fact, the increase in resistance is not enough to show in tests conducted to determine if any exists. This is due to the excess area of the duct and passage in the facepiece provided for the flow required for respiration.

For discharging exhaled air from the facepiece, openings 1*d* are provided in the side portions 1*c*. Interposed in each of these openings is an exhalation valve 10 so arranged that during inhalation the valves are caused to seat themselves and during exhalation the increased pressure allows air to pass into the outside atmosphere. The type of exhalation valve represented is old in the art, but the mounting provided for the exhalation valve forms a part of this invention. The material of the facepiece about each opening is molded to form a short duct 1*e* that extends a short distance into the concave portion of the facepiece and terminates in a supporting flange 1*f* that extends inwardly closing off a part of the opening.

The exhalation valve 10 has a housing 11 that encloses the valve. The housing is threaded to an inner valve assembly 13 and has an inner face 12 cooperative with an extending flange 14 of the valve assembly 13 to form a gripper means for the flange 1*f* of the facepiece. A valve 10*a* is seated on the assembly 13 and is movable outwardly or into the housing for opening the passage and relieving pressure in the facepiece. Suitable outlet openings 10*c* are provided in the valve assembly for introducing air to the valve while openings 11*a* are provided in the housing 11 through which the exhaled air is discharged into the atmosphere. In mounting, the housing 11 is placed on the outer side of the flange 1*f* and the valve assembly 13 is threaded into the housing through the flange of the duct until the flange 14 of the assembly 13 presses the flange of the duct tightly against the inner surface 12 of the housing to seal the valve to the facepiece. The valve 10*a* controls movement of air through the opening in the facepiece. Normally, the valve is held closed by a spring, but the valve and spring are responsive to exhalation pressures to move the valve to an open position and discharge air through the opening.

To prevent the moldable material gripped between the surfaces from being displaced, a sealing washer 16 is placed around the outer surface of the duct and flange to give the material some rigidity and to prevent the facepiece material from working out between the gripping surfaces

of the exhalation valve. With this mounting of the exhalation valve, the valve is disposed in the cavity of the facepiece in the duct 1*e*. In this position, a certain amount of heat is conveyed to the valve to prevent freezing of the moisture that may be deposited during exhalation.

In order to further protect the valve, a louver 17 is formed integrally with the facepiece and outwardly of the facepiece body which completely encloses the outside of the valve from the atmosphere. It is arranged to completely enclose the valve and extend rearwardly beyond the exhalation valve and terminates in an outlet 18.

Due to variations in facial size, it is advisable to include some form of an adjustable member about the nose, such as a wire 20 mounted to the body by means of lugs 21 formed integrally with the facepiece. This wire 20 is preferably positioned substantially in alignment with the inner periphery of the facepiece about the nose portion and is effective to hold the material against the face when brought against the nose. It is recognized that this addition of using an outer clip fastened on to the facepiece is not new but the particular arrangement illustrated in the drawing, that is, mounting the wire member in a somewhat vertical postion and in combination with the shaped lip about this position provides a very effective means for sealing the facepiece about the nose.

It is advantageous for some purposes to provide some form of mounting for a microphone and it has been found that a shaped portion 26 can be formed integrally with that portion of the facepiece located in front of the mouth and of such construction that it conforms to the housing of the microphone and of such size that it is yieldable. By inserting the housing into the shaped portion, it is tightly gripped and held in position. In actual molding, the front end can be completely closed off and can be made to accommodate a wire 27 of the microphone by cutting an opening into the end and passing the wire through this opening after the microphone has been assembled into this portion.

As a means of holding the facepiece in protective position, certain straps are necessary which obtain support from the head. An improved means for attaching head straps to the facepiece and to a helmet worn by the wearer is to attach straps 28 and 29 to each side of the facepiece by means of button fasteners. The upper strap 28 carries a fastener 30 at its outer end which has an inwardly directed hook that engages a cooperating fastener mounted on to the hat. This quick attachment is advantageous in many instances where the facepiece is worn. The lower strap is attached to the helmet by means of a buckle 32. Frequently, the facepiece is mounted to the helmet by means of the lower strap and is not brought into operative position on the face until atmospheres are encountered which demand protection measures. This means on the upper strap provides for quick and convenient assembly to a protective position.

Since this facepiece is especially adapted for low temperature use, it is of advantage to cover the outer surface of the body of the facepiece with some form of insulating material as sponge rubber. In one such construction, an insulating body is provided having an inner surface complementary to the outer surface of the body. The insulating body is attached to the body by applying an adhesive and heat and pressure to integrally attach the insulating body to the face-

piece body. For some purposes, covering only the louvers 17 enclosing the exhalation valves with insulating material gives greater protection for the valves and insures against their freezing.

In connection with the baffle arrangement, baffles 8 and 9 being interposed in the inlet to the facepiece body to deflect the air entering the facepiece to the chamber 5, the insulating layer on the outside of the facepiece body accentuates the function of the warming chamber and provides more comfort for the wearer. It is to be observed, however, that some comfort is obtained from the interposition of the baffles due to elimination of an impingement action of entering air against the face and a material reduction in the velocity of air before inhalation by the wearer. This chamber 5, also, provides a reservoir for collection of moisture discharged in use of the facepiece. The condensate, in some instances, may freeze and to remove the face from contact with the condensate eliminates discomfort.

According to the provisions of the patent statutes, we have explained the principle and mode of operation of our invention, and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A facepiece comprising a concave mask of protective material formed to enclose the nose and mouth and extending back under the chin, the lower portion of said mask being provided with an inlet in front of the chin, a face-engaging lip integral with the edge of the mask and extending inwardly and forwardly therefrom, the lower portion of said lip being formed to fit under and in front of the chin in contact therewith and being spaced from the bottom and front of the mask to form a gas-warming chamber under the chin, the front of said chamber opening upwardly into the mask behind said inlet, and baffle means projecting inwardly from the mask into the path of a breathing gas entering through said inlet and positioned to direct said gas into said chamber before it passes up into the mask for breathing.

2. A facepiece comprising a concave mask of protective material formed to enclose the nose and mouth and extending back under the chin, the lower portion of said mask being provided with an inlet in front of the chin, a face-engaging lip integral with the edge of the mask and extending inwardly and forwardly therefrom, the lower portion of said lip being formed to fit under and in front of the chin in contact therewith and being spaced from the bottom and front of the mask to form a gas-warming chamber under the chin, the front of said chamber opening upwardly into the mask behind said inlet, and baffle means integral with the mask and extending transversely thereof, said means extending across the path of a breathing gas entering through said inlet and positioned to direct said gas in a thin wide stream into said chamber before it passes up into the mask for breathing.

3. A facepiece comprising a concave mask of protective material formed to enclose the nose and mouth and extending back under the chin, the lower portion of said mask being provided with an inlet in front of the chin, a face-engaging lip integral with the edge of the mask and extending inwardly and forwardly therefrom, the lower portion of said lip being formed to fit under and in front of the chin in contact therewith and being spaced from the bottom and front of the mask to form a gas-warming chamber under the chin, the front of said chamber opening upwardly into the mask behind said inlet, a baffle member extending upwardly between said inlet and chamber to deflect incoming breathing gas upwardly in front of the chamber, and another baffle member projecting rearwardly from the front of the mask across the top of said first-mentioned baffle member in closely spaced relation thereto to deflect said upflowing gas downwardly in a thin, wide stream into said chamber before it passes up into the mask for breathing.

4. A facepiece comprising a concave mask of protective material formed to enclose the nose and mouth and extending back under the chin, the lower portion of said mask being provided with an inlet in front of the chin, a face-engaging lip integral with the edge of the mask and extending inwardly and forwardly therefrom, the lower portion of said lip being formed to fit under and in front of the chin in contact therewith and being spaced from the bottom and front of the mask to form a gas-warming chamber under the chin, the front of said chamber opening upwardly into the mask behind said inlet, baffle means projecting inwardly from the mask into the path of a breathing gas entering through said inlet and positioned to direct said gas into said chamber before it passes up into the mask for breathing, straps connected to the opposite sides of the mask, and a hook on the rear end of each strap adapted to engage a complementary member on a helmet worn by the wearer of the facepiece.

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