

April 21, 1959

H. W. SEELER
BREATHING APPARATUS

2,882,896

Filed July 18, 1955

3 Sheets-Sheet 1

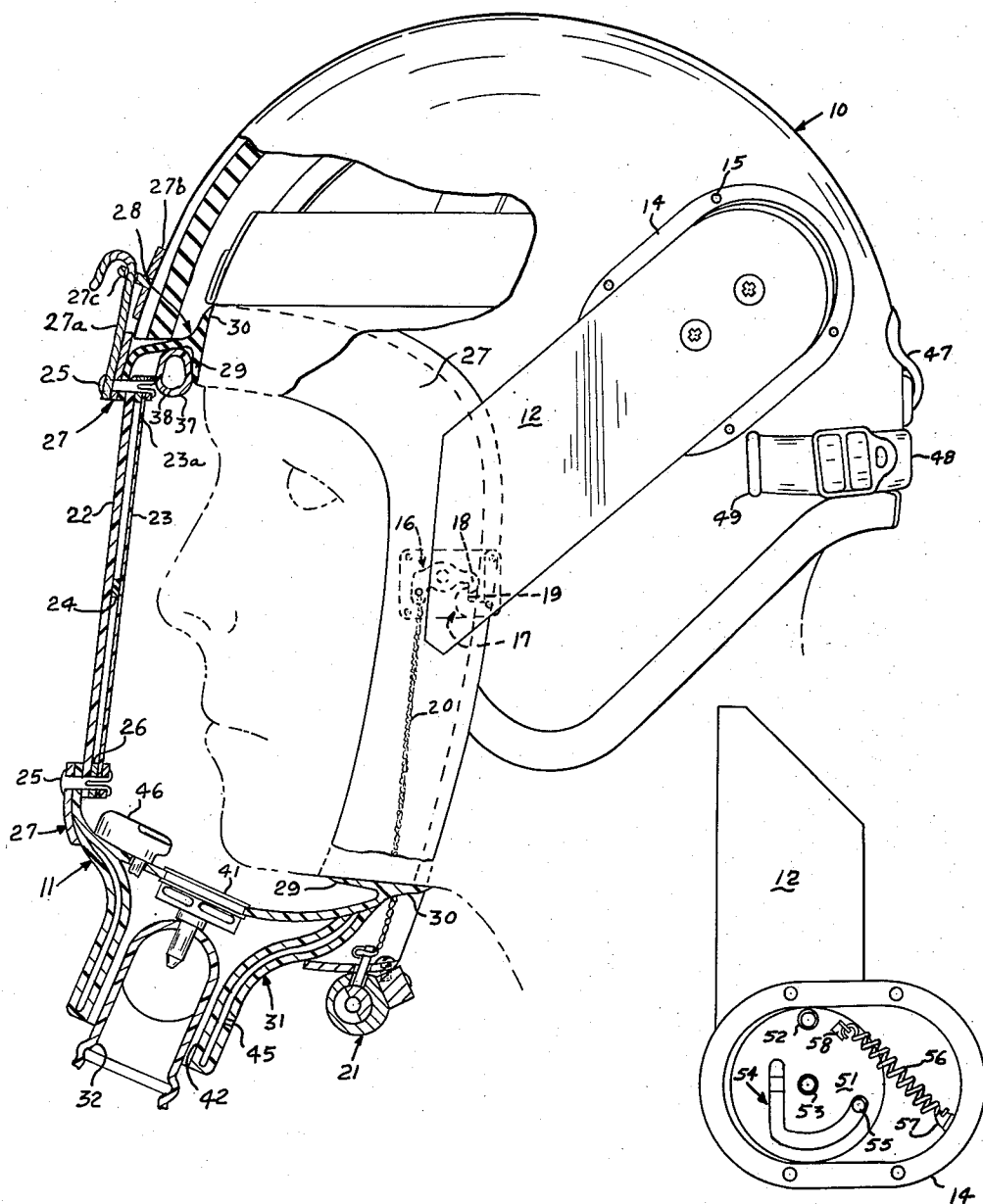


Fig-1

Fig-5

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3 Sheets-Sheet 2

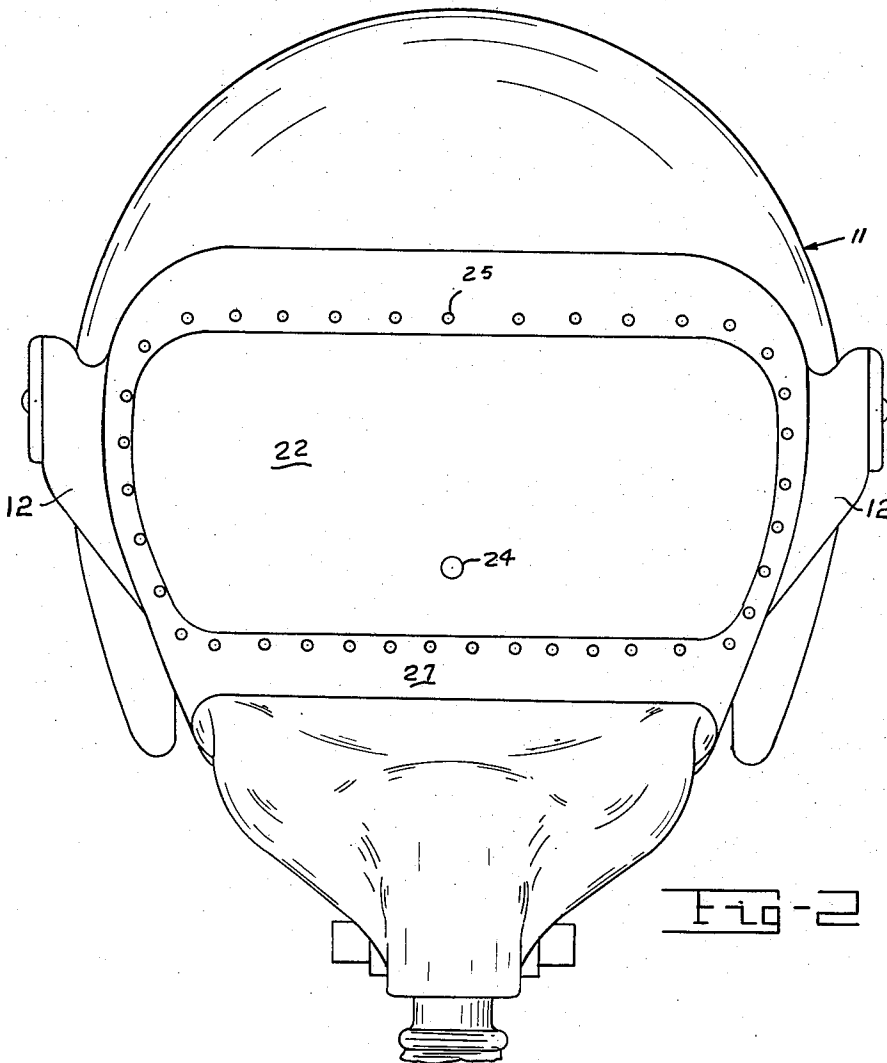


Fig-2

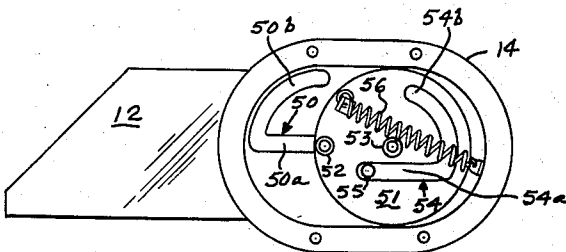


Fig-4

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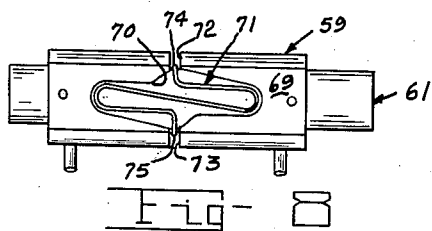
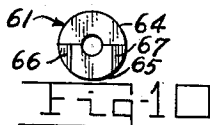
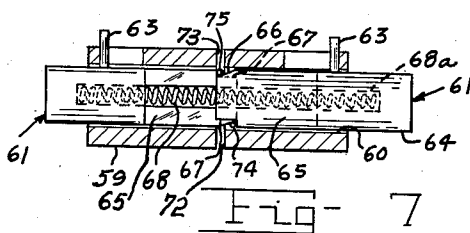
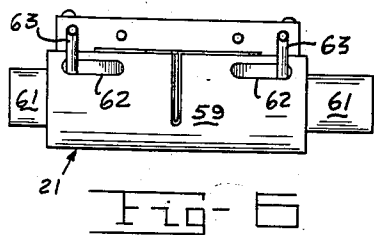
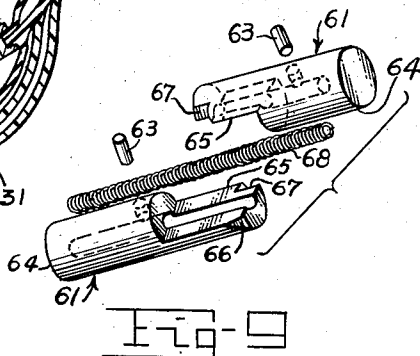
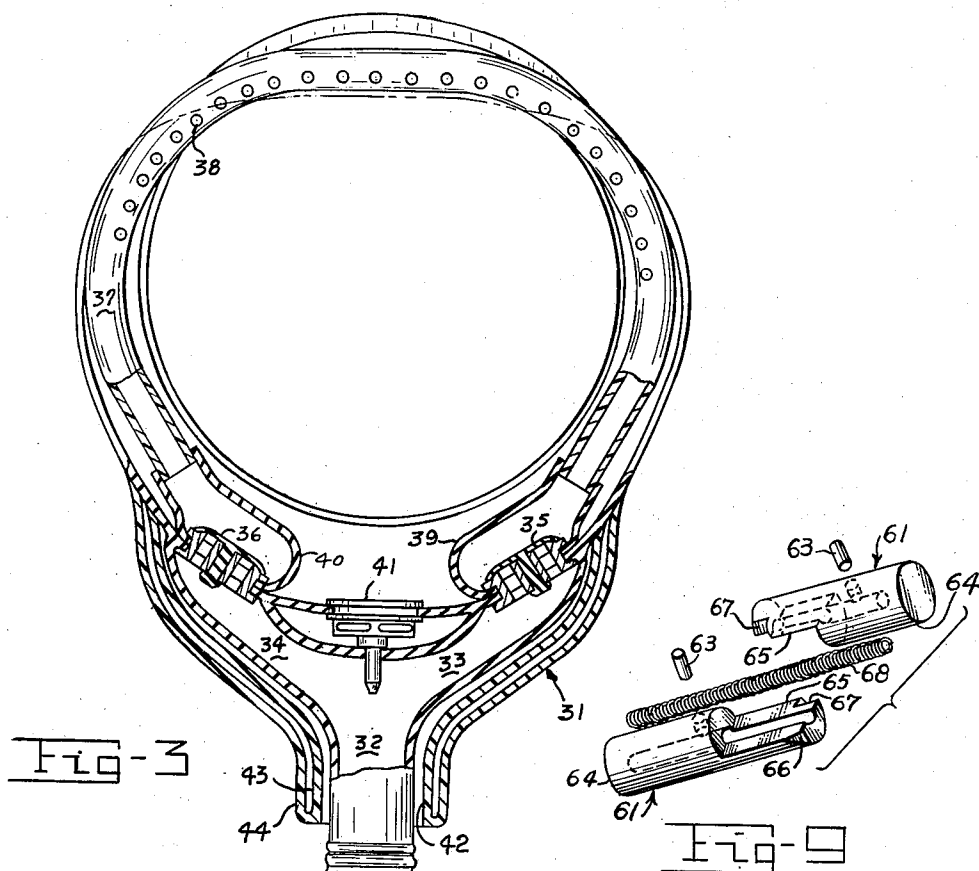
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3 Sheets-Sheet 3



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2,882,896

BREATHING APPARATUS

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13 Claims. (Cl. 128—142)

(Granted under Title 35, U.S. Code (1952), sec. 266)

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

This invention relates to breathing apparatus for use in high altitude flying and, more particularly, to a breathing mask for use with an aviator's helmet and the apparatus for connecting and locking the mask to the helmet.

In high altitude flying it is necessary to supply oxygen to the aviator. This oxygen is usually supplied to a mask that is fitted over the face of an aviator and is connected to his helmet. One of the main problems in high altitude flying due to the low temperature ambient is the freezing of the valves, which control the inlet and outlet flow of air to the mask interior, and the formation of ice on the window portion of the mask. Most of the present devices employ electric heating apparatus to prevent this valve freezing and ice formation. However, there exists the problem of the interruption of the supply of electric current and this, of course, renders the heating means inactive. In order to prevent the ice formation on the window portion of the mask, it also has been the practice to provide an inner mask that insures that no moisture from the wearer of the mask, due to exhalation, reaches the window portion. Naturally, this inner mask is uncomfortable and renders the mask undesirable for long periods of wear. The present invention satisfactorily solves these problems by eliminating the requirements for the auxiliary heating means and the inner mask.

A primary object of this invention is to provide a breathing mask that prevents moisture on the window portion without the use of auxiliary heating means.

An object of this invention is to provide a helmet that is designed to prevent freezing of any of the essential parts without the use of auxiliary heating means.

A further object of this invention is to provide a breathing mask having spaced lenses to prevent moisture formation on the inner surface of the interior portion thereof.

Another object of this invention is to provide a breathing mask in which the oxygen supply is directed over the window portion to prevent moisture formation on the inner surface of the interior thereof.

A still further object of this invention is to provide a locking mechanism, which requires both latching members to be released simultaneously before the breathing mask may be unlocked from the helmet.

Still another object of this invention is to provide a mechanism that permits quick removal of the breathing mask from the face of the wearer of the helmet.

Other objects of the invention will be readily perceived from the following description.

This invention relates to a helmet for an aviator including a breathing mask fitting over the face of the aviator. The mask is pivotally connected to the helmet by suitable means and other means are provided to releasably lock the mask to the helmet.

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The attached drawings illustrate a preferred embodiment of the invention, in which—

Figure 1 is a side elevational view partly in section of a helmet and a breathing mask including the present invention;

Figure 2 is a front elevational view of the breathing mask;

Figure 3 is a front elevational view partly in section of the breathing mask with a portion removed;

Figure 4 is an elevational view of the apparatus connecting the mask to the helmet when the breathing mask is pressed against the face of the wearer;

Figure 5 is an elevational view of the apparatus of Figure 4 when the breathing mask is removed from the face of the wearer;

Figure 6 is an elevational view of the releasing mechanism;

Figure 7 is a sectional view partly in elevation of the apparatus of Figure 6;

Figure 8 is a side elevational view of the apparatus of Figure 6 with a portion thereof removed;

Fig. 9 is an exploded view of a portion of the releasing mechanism of Fig. 7; and

Fig. 10 is an end elevational view of a portion of the releasing mechanism of Fig. 9.

Referring to the drawings and particularly Figure 1, there is shown a helmet 10 being worn by an aviator. A breathing mask 11 is fitted against the face of the wearer and connected to the helmet by a member 12, which is secured to the mask by suitable means such as welding, for example.

The member 12 cooperates with an ear 14 that is fixed to the helmet 10 preferably by screws 15 though other suitable means may be employed, if desired. The member 12 cooperates with the ear 14 to pivotally connect the breathing mask 11 to the helmet whereby the breathing mask may be removed from the face of the wearer without necessitating removal of the helmet. The cooperating parts of the member 12 and the ear 14 will be described in detail hereinafter.

The breathing mask 11 is held in position against the face of the wearer by releasable locking means including a member 16 pivotally connected to the mask and a second member 17 fixed to the helmet 10. The member 16 has a portion 18 that cooperates with a hook portion 19 of the member 17 (see Figure 1). It will be understood that the members 16 and 18 are mounted on both sides of the mask and helmet though only one side is shown in Figure 1. Similarly the members 12 and the ears 14 are disposed on both sides of the helmet. Each of the members 16 has a connecting element 20, such as a wire, for example, secured to the end remote from the portion 18 to pivot the member 16 to release the member 16 from the member 17 to allow removal of the mask from the face of the wearer. Each of these connecting elements 20 is connected to a releasing apparatus 21 that will be described in detail hereinafter. The releasing mechanism 21 is so designed that both members 16 must be pivoted simultaneously in order for the mask to be unlocked from the helmet. It will be understood that a spring (not shown) is employed to urge the portion 18 into cooperation with the hook portion 19 when the mask is placed against the face.

The mask 11 includes a window portion consisting of an outer transparent member 22 and an inner transparent member 23. These two members are spaced apart by a plastic button 24 disposed therebetween (see Figures 1 and 2). The plastic button 24 and the outer member 22 have the same thickness whereas the inner member is much thinner with respect thereto. The preferred thickness of the member 22 and the button 24 are .125" and

the inner member .010". This relation serves to prevent moisture from forming on the inner surface of the inner transparent member 23 due to the fact that the heat transfer from the warm air inside the mask through the relatively thin member 23 to the air in the space defined by the button 24 is faster than the heat transfer from the cold air through the relatively thick member 22.

These two members 22 and 23 are joined together by a plurality of rivets 25 though other suitable securing means may be employed, if desired. A gasket member 26 seals the space between the members 22 and 23 by extending around the periphery thereof as clearly shown in Figure 1. It will be noted that the rivets 25 serve to hold the gasket 26 in position. The inner transparent member 23 has an opening 23a of approximately .010" in diameter to prevent a rupture in the inclosed space formed by the gasket 26 and the members 22 and 23 due to an increased volume therein as the altitude of the plane increases. However, this opening is sufficiently small so that the air within the space escapes without permitting moisture to enter.

The rivets 25 also secure the members 22 and 23 and the gasket 26 to a metallic support frame 27. Both the member 12 and the member 16 are secured to this metallic support frame 27 of the breathing mask 11. A member 27a having a hooked end is secured to the metallic frame 27 by the rivets 25 and cooperates with a member 27b which is fastened to the helmet 10 by suitable means (not shown), to prevent the mask from slipping downwardly and aid the locking means in holding the mask against the face. This is accomplished by the hooked end of member 27a passing through an opening 27c in member 27b as shown in Figure 1.

The breathing mask 11 also includes a rubber sealing strip 28, which is T-shaped in cross section, fitting against the face of the wearer. The portion or lip 29 of the strip 28 enables a positive pressure to be maintained within the interior of the mask 11 while the lip 30 permits a negative pressure to be maintained within the interior of the mask when it is desired. When it is desired to maintain a positive pressure within the interior of the mask, this positive pressure forces the lip 29 of the sealing strip 28 against the face of the wearer. When a negative pressure is desired to be maintained within the mask interior, the greater pressure outside the mask forces the lip 30 against the face of the wearer. Whether positive or negative pressure is desired to be maintained within the interior of the mask depends on the altitude and the type of oxygen supply equipment. This strip 28 is also secured to the metallic support frame 27 by the rivets 25 (see Figure 1).

In forming the sealing strip 28, a valve body portion 31 is provided in the lowermost portion of the strip. The valve body 31 includes an inlet passage 32 that is connected to a suitable supply of oxygen. This inlet passage 32 divides into branches 33 and 34, as clearly shown in Figure 3, that lead to check valves 35 and 36, respectively. A plastic tubing 37 having a plurality of apertures 38 therein is disposed around the edges of the transparent member 23 to direct oxygen against the inner transparent member 23. The ends of the tubing 37 have rubber caps 39 and 40 thereon that fit over the check valves 35 and 36, respectively (see Figure 3). Thus, when the wearer of the mask breathes inwardly the check valves 35 and 36 are opened and oxygen flows therethrough into the tubing 37 and through the apertures 38 to be directed onto the inner transparent member 23 to aid in preventing formation of moisture on the inner surface thereof.

An exhaust port is provided in the valve body 31 and has a check valve 41 disposed therein. This port, which is controlled by the check valve 41, provides communication between the interior of the mask and the exhaust passage 42, which surrounds the inlet passage 32. The wall of the exhaust passage 42 consists of two spaced

walls 43 and 44 that are joined together to serve as a heat transfer barrier between the low ambient temperature and the check valves. This double wall heat transfer barrier enables the exhaust temperature to transfer some of its heat to the oxygen in the inlet passage 32. As seen in Figure 1, an opening 45 preferably of approximately .020" in diameter is provided in the outer wall 44 to prevent deformation of the walls 43 and 44 due to an increased volume therein as the altitude of the plane increases. However, this opening is sufficiently small so that air escapes from the space but low temperature air due to high altitude ambients does not enter the space.

A microphone 46 is shown disposed in the valve body 31 of the breathing mask and an electrical cable 47 is shown on the rear part of the helmet. Since these are of conventional configuration and form no part of the invention, they will not be described further. An adjustable strap 48 is provided on the rear of the helmet and passes through openings 49 (one shown) so that it passes behind the wearer's neck to permit adjustment of the helmet on the wearer's head. Tightening of the strap 48 presses the helmet backward (or the head forward) to increase the pressure between the helmet and the wearer's forehead. This also does not relate to the invention and will not be described further.

Referring to Figures 4 and 5, the pivotal connecting means will be described in further detail. As previously stated above, the member 12 is secured to the frame 27 of the mask 11 and the ear 14 is joined to the helmet 10. The ear 14 has a slot 50 in the surface adjacent the member 12. This slot has a portion 50a that extends in the direction of the longitudinal axis of the member 12 and a curved portion 50b. A plate 51 is disposed in the interior of the ear and is secured to the member 12 by two studs 52 and 53, which pass through the slot 50 of the ear 14. The location of the studs 52 and 53 in the slot 50 insures that the member 12 moves according to the configuration of the slot. Thus, the member 12 moves in the direction defined by the portion 50a of the slot 50 until the stud 52 reaches the portion 50b. At this time, the member 12 rotates along the curve defined by the curved portion 50b of the slot. This results in the mask 11 being removed from the face of the wearer before it is pivoted upwardly away from the wearer. It will be understood that the studs 52 and 53 are spaced a sufficient distance apart so that the stud 52 may pass along the curved portion 50b of the slot 50 while the stud 53 remains in the portion 50a of the slot 50 to serve as a pivotal axis. The plate 51 has a slot 54 therein that includes a portion 54a extending in the same direction as the portion 50a of the slot 50. The slot 54 also includes a curved portion 54b. The ear 14 has a stud 55 mounted on the interior thereof that cooperates with the slot 54 to guide the plate 51 when it is desired to remove the mask from the face of the wearer.

A resilient biasing means is provided between the plate 51 and the ear 14 and includes a spring 56 connected to a bracket 57 on the ear 14 and a bracket 58 on the plate 51. This spring serves to hold the member 12 and thus the mask 11 in whichever position it is disposed. For example, the member 12 in the position of Figure 4 is holding the mask against the face of the wearer and the spring 56 is exerting a force to hold the mask 11 in this position. Similarly, in Figure 5, the parts are shown in the relationship wherein the mask is removed from the face of the wearer and the spring 56 is tending to hold the mask away from the face of the wearer.

The releasing mechanism 21, which unlocks the member 16 from the member 17 so that the mask may be pivoted away from the face of the wearer, is shown in detail in Figures 6 to 8. This releasing mechanism 21 includes a tubular member or casing 59 having a passage or opening 60 extending therethrough. A plunger or piston button 61 is disposed in each end of the passage 60. The tubular

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member 59 has a slot 62 adjacent each end thereof (see Figure 6 through which a stud 63 extends. Each of these studs 63 is connected to a plunger 61 to hold a portion of each of the plungers within the passage 60 of the tubular member 59. The other end of each of these studs 63 is connected to one of the connecting elements 20. Each of the plungers 61 includes a cylindrical portion 64 to which the stud 63 is secured and an undercut portion 65. At the end of each of the undercut portions, a cammed surface 66 is provided on one edge or side and a shoulder 67 is formed along the other edge or side. The undercut portions 65 of the two plungers 61 overlap for substantially the length of the shoulders 67 when the plungers are biased to their outermost position (i.e. when the studs 63 are against the outermost edge of the slots 62) by a spring 68 having its ends disposed within passages 68a in the cylindrical portions 64 of the plungers 61.

The tubular member 59 includes a flat portion 69 having a sunken or cutout portion 70 in which a portion of a resilient spring 71 is disposed (see Figure 8). The tubular casing 59 includes passages 72 and 73 providing communication between the portion 70 and the passage 60. A leg 74 of the spring 71 extends through the passage 72 into the passage 60. A leg 75 of the spring 71 extends through the passage 73 into the passage 60.

As shown in Figure 7, the leg 74 bears against the shoulder 67 of one of the plungers 61 while the leg 75 bears against the shoulder of the other plunger 61. Attempted inward movement of one of the plungers 61 does not move the plunger 61 inward since either the spring leg 74 or the spring leg 75 is acting against the shoulder 67 thereof. The other leg 74 or 75 of the spring 71 would be cammed outward by the cammed surface 66 of the plunger that it is attempted to move inwardly. However, when both plungers 61 are moved inward, each of the cammed surfaces 66 moves one of the legs 74 and 75 outward so that both the legs 74 and 75 clear the shoulders 67 whereby the plungers 61 may move inwardly. This moves the studs 63 towards each other whereby the connecting elements 20 are actuated to pivot the members 16 to unlock the mask from the helmet. Thus, the releasing mechanism 21 releases both locking members simultaneously but prevents accidental unlocking of the one of the members 16 due to one of the plungers being accidentally pushed inwardly.

An advantage of this invention is that it provides a helmet having an anti-free system, i.e., a system that will not freeze either the valves or form ice on the window.

Another advantage of this invention is that the locking means prevents accidental release of one of the latching members. This invention also has the advantage of allowing the exhaled gas to warm the incoming oxygen.

Another advantage of this invention is that the inner mask is eliminated so that longer periods of wearing the breathing apparatus comfortably are provided. Still another advantage of this invention is that the breathing apparatus does not require an inner mask to prevent moisture formation on the window.

For purposes of exemplification, a particular embodiment of the invention has been shown and described according to the best present understanding thereof. However, it will be apparent that changes and modifications in the arrangement and construction of the parts thereof may be resorted to without departing from the true spirit and scope of the invention.

I claim:

1. A helmet for an aviator including a breathing mask fitting over the face of the aviator, means releasably securing the breathing mask to the helmet, the breathing mask including a window portion, said window portion including two spaced transparent members, the outer of said members being thicker than the inner of said members, said inner member having an opening therein of a size to permit leakage of air from the space between said two transparent members to prevent rupture in the space

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as the altitude increases but to prevent flow of air into the space from the interior of the mask, means to supply oxygen adjacent the inner of said members, and means to exhaust exhaled air from the mask.

2. An oxygen pressure mask including a body adapted to fit over the face of the wearer, means on said body for sealing the body against the face, said body having an opening therein for visual view by the wearer, a pair of transparent members mounted in said opening, means disposed between said members to maintain said members in spaced relation, said spacing means and the outer member being of substantially the same thickness, the inner member being substantially thinner than said outer member, said inner member having an opening therein of a size to permit leakage of air from the space between said two transparent members to prevent rupture in the space as the altitude increases but to prevent flow of air into the space from the interior of the mask, means in said body to supply oxygen adjacent the inner transparent member to the wearer, a port in said body communicating with the exterior of said body, and valve means in said port to control said port whereby exhaled air may pass through said port to the exterior of said body.

3. A helmet for an aviator including a breathing mask fitting over the face of the aviator, means pivotally connecting the mask to the helmet, and means releasably locking the mask to the helmet in which the pivotally connecting means includes an ear secured to the exterior of the helmet, said ear having a slot therein, a member secured to said mask, said member having a pair of spaced studs disposed in the slot of the ear, a plate disposed in the interior of said ear and secured to said studs, said plate having a slot therein, and a stud mounted on the interior of said ear for cooperation with the slot in the plate, said slot in said ear and said slot in said plate being so designed that said member may be moved first in the direction of its longitudinal axis and then rotated through substantially a right angle to lift the mask from the face of the wearer.

4. A helmet for an aviator including a breathing mask fitting over the face of the aviator, means pivotally connecting the mask to the helmet, and means releasably locking the mask to the helmet in which said releasable locking means includes a member pivotally mounted on the mask, a second member fixed to said helmet, said members having cooperating portions to lock said mask to said helmet, a releasing member fixed to said mask, an element connected at one end to said first member, the other end of said element connecting to said releasing member, and said releasing member including means to actuate said connecting element to pivot said first member to unlock the mask from the helmet.

5. A helmet for an aviator including a breathing mask fitting over the face of the aviator, means pivotally connecting the mask to the helmet, and means releasably locking the mask to the helmet in which said releasable locking means includes a pair of first members pivotally mounted on opposite sides of the mask, a pair of second members fixed to opposite sides of said helmet, said first and second members on the same side of said mask and said helmet having cooperating portions to lock said mask to said helmet, a releasing member fixed to said mask, said releasing member including a tubular member having an opening extending therethrough, a pair of plungers disposed at opposite ends of said opening of said tubular member, said tubular member having a pair of spaced slots therein, a stud attached to each of said plungers and extending through one of said slots, an element connected at one end to one of said first members, another element connected at one end to the other of said first members, each of said studs being connected to the other end of one of said connecting elements, and means cooperating with said plungers to prevent movement of one of said plungers alone and to permit simultaneous inward movement of both of said plungers to unlock the mask from the helmet.

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6. A releasing mechanism including a tubular member, said member having a passage extending therethrough, said member having a pair of slots in communication with said passage and disposed at opposite ends thereof, a pair of plungers disposed in opposite ends of said passage, a stud attached to each of said plungers, each of said studs extending through one of said slots, and resilient means partially positioned within said passage, said plungers being adapted to cooperate with the portion of said resilient means disposed within said passage to prevent movement of one of said plungers alone and to permit simultaneous inward movement of both of said plungers.

7. A releasing mechanism including a tubular member, said member having a passage extending therethrough, said member having a pair of slots in communication with said passage and disposed at opposite ends thereof, a pair of plungers disposed in opposite ends of said passage, a stud attached to each of said plungers, each of said studs extending through one of said slots, and resilient means partially positioned within said passage, each of said plungers having a cammed surface on its innermost end, said cammed surfaces cooperating with said resilient means to permit simultaneous inward movement of both of said plungers.

8. A releasing mechanism including a tubular member, said member having a passage extending therethrough, said member having a pair of slots in communication with said passage disposed at opposite ends thereof, a pair of plungers disposed in opposite ends of said passage, a stud attached to each of said plungers, each of said studs extending through one of said slots, and resilient means partially positioned within said passage, each of said plungers having an undercut portion, each of said undercut portions having a shoulder along one side and a cammed surface along the opposite side, the undercut portions overlapping for substantially the length of the shoulder thereon, said shoulders contacting separate parts of the resilient means to prevent inward movement of one of said plungers, said cammed surfaces moving said parts of said resilient means out of the path of said shoulders to permit simultaneous inward movement of said plungers.

9. A breathing mask for use with an aviator's helmet, said breathing mask fitting over the face of the aviator, said breathing mask including a T-shaped strip extending about the face of the wearer to provide a seal against both negative and positive pressures within the interior of the mask, said mask including an opening for visual view by the wearer, a pair of transparent members mounted in said opening, means disposed between said members to maintain said members in spaced relation, a gasket sealing the space between said members, said spacing means and said outer transparent member being of substantially the same thickness, said inner member being

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substantially thinner than said outer member, said inner member having an opening therein of a size to permit leakage of air from the space between said two transparent members to prevent rupture in the space as the altitude increases but to prevent flow of air into the space from the interior of the mask, means positioned within the mask to supply oxygen adjacent the inner transparent member, and means to permit the exhausting of exhaled air from the interior of the mask.

10. A helmet for an aviator including a breathing mask fitting over the face of the aviator, means pivotally connecting the mask to the helmet, and means releasably locking the mask to the helmet in which the pivotally connecting means includes an ear secured to the exterior of the helmet, a member secured to said mask, and cooperating means on said ear and said member whereby said member may be moved first in the direction of its longitudinal axis and then rotated through substantially a right angle to lift the mask from the face of the wearer.

11. A helmet for an aviator including a breathing mask fitting over the face of the aviator, means pivotally connecting the mask to the helmet, and means releasably locking the mask to the helmet in which said releasable locking means includes a member pivotally mounted on the mask, a second member fixed to said helmet, said members having cooperating portions to lock said mask to said helmet, and means fixed to said mask and secured to said first member to pivot said first member to unlock the mask from the helmet.

12. A releasing member including a tubular member, said member having a passage extending therethrough, a movable means disposed within said passage of said member, and resilient means partially disposed within said passage of said member to cooperate with said movable means whereby inward movement of one of said movable means alone is prevented and simultaneous inward movement of both of said movable means is permitted.

13. A helmet according to claim 10 including biasing means connected to the ear and the member, said biasing means exerting a force to hold the member in both of its positions.

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