

Nov. 25, 1958

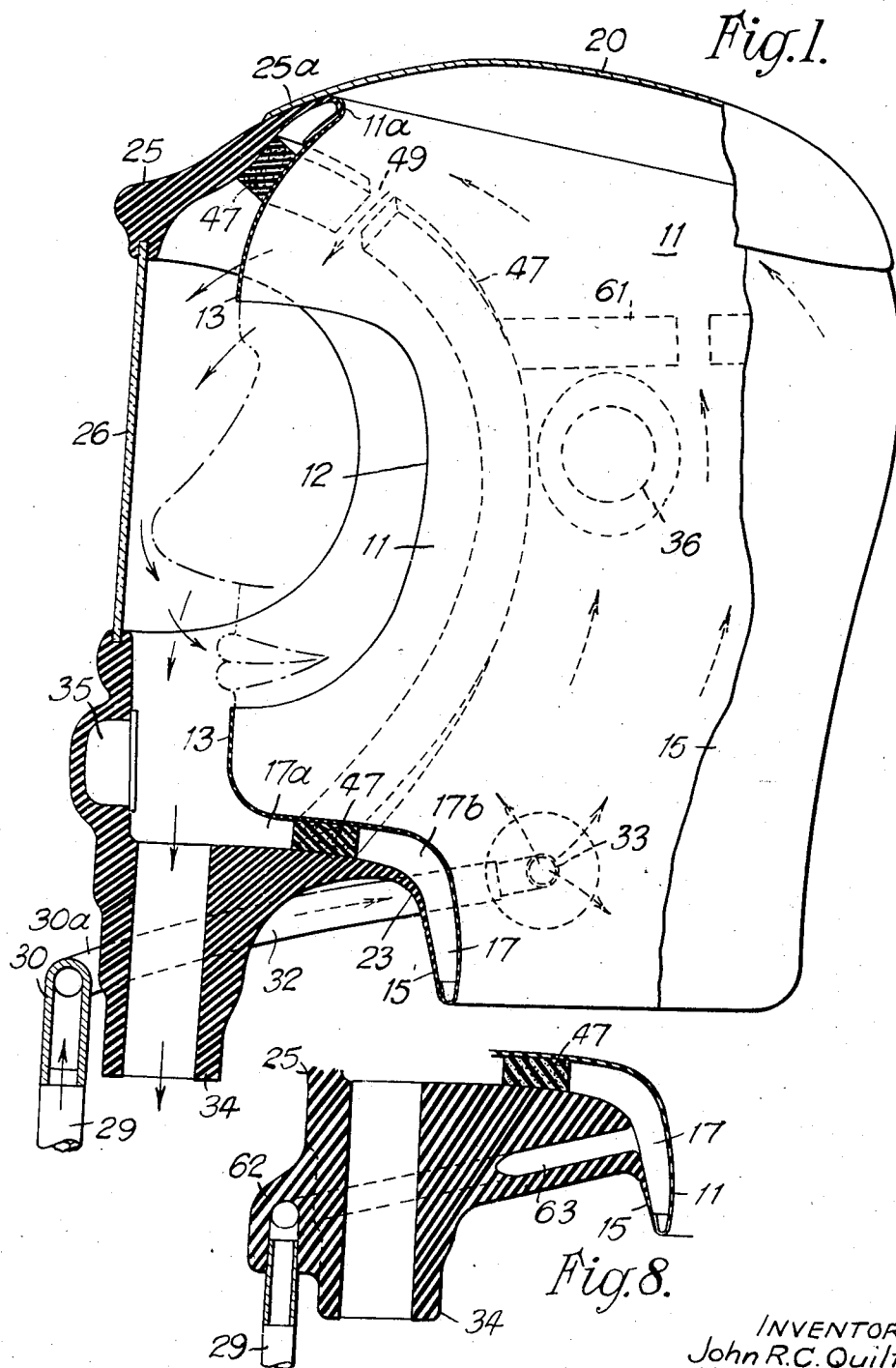
J. R. C. QUILTER ET AL

2,861,568

PRESSURIZED HELMET FOR AVIATORS

Filed Sept. 27, 1950

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

Fig. 2.

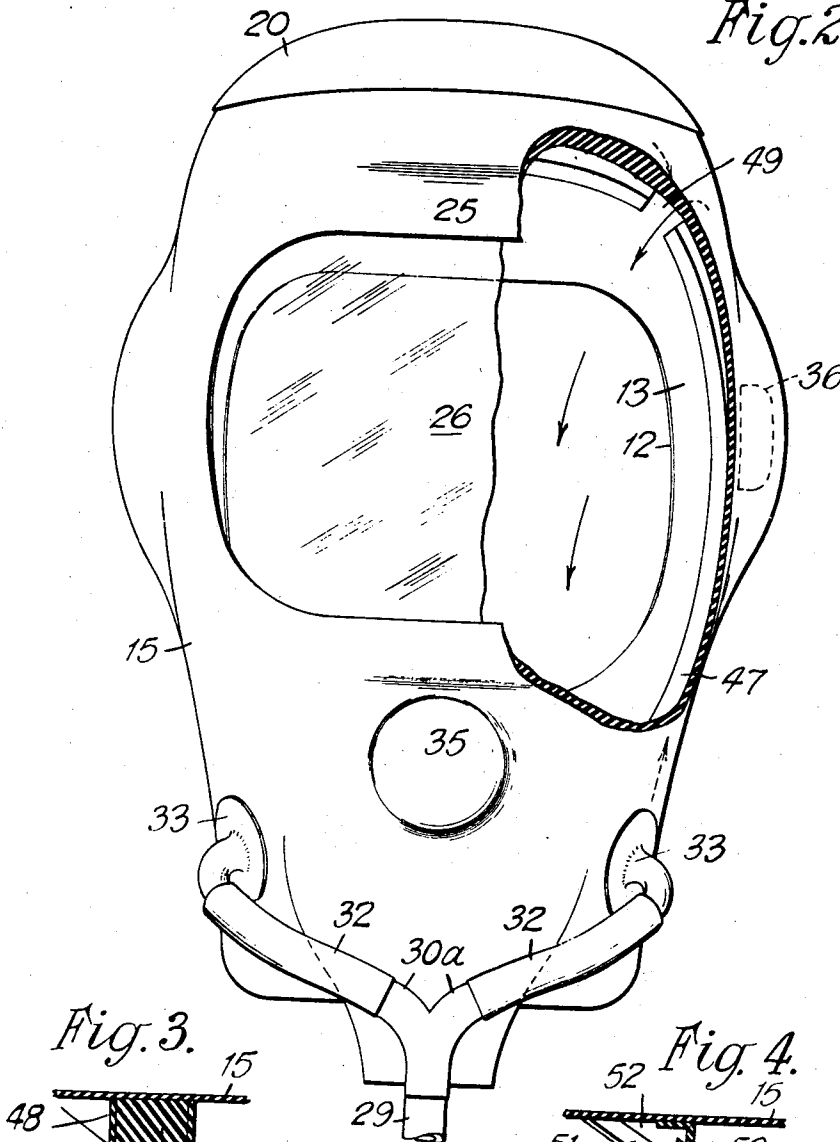


Fig. 3.

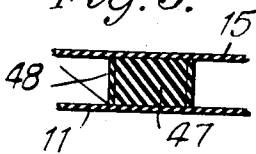


Fig. 4.

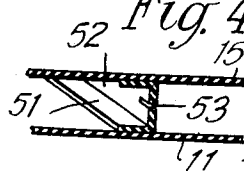


Fig. 5.

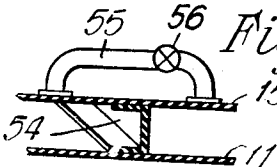
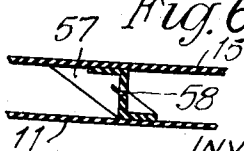


Fig. 6.



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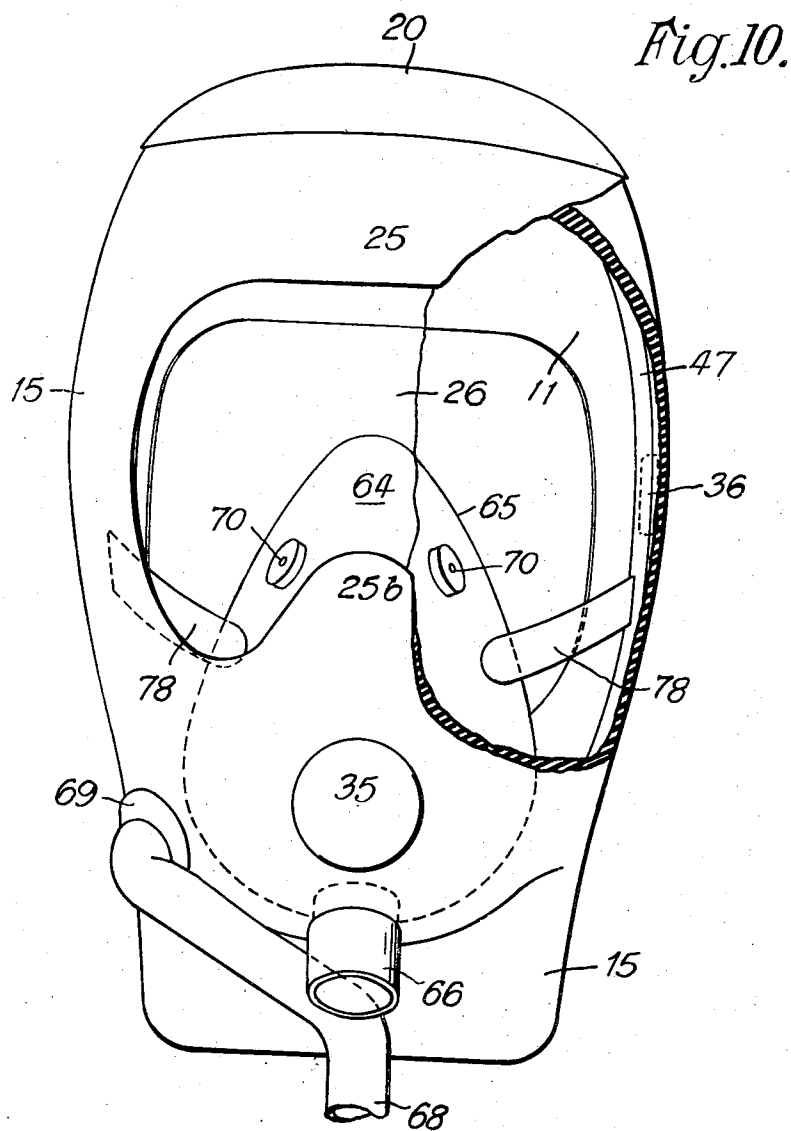
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1

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PRESSURIZED HELMET FOR AVIATORS

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Application September 27, 1950, Serial No. 186,949

20 Claims. (Cl. 128—141)

This application is a continuation-in-part of our pending application Serial No. 137,692, filed January 10, 1950.

The invention relates to pressurized helmets for aviators, including air crews and passengers, so as to render them capable of breathing a supply of oxygen under pressure when the aircraft reaches high altitudes, for example above 40,000 feet.

As explained in our aforesaid pending application, it is known that the human body, even when supplied with oxygen at a suitable pressure by way of a nose and mouth mask, is incapable of maintaining life at altitudes in excess of 45,000 feet above sea level, when clothed in normal flying equipment, and having no external partial pressure applied to the head and body. For high-altitude flying, it is therefore necessary to use equipment such as a pressurized helmet in conjunction with a pressurized flying suit which applies pressure to the whole or greater part of the body, oxygen being transmitted through the helmet to the wearer's lungs, for example at approximately $2\frac{1}{2}$ pounds per square inch above the ambient pressure: the helmet should be so arranged as to allow for the discharge of the exhaled gases and should also be adapted to exert pressure upon the external surfaces of the head and neck, or upon certain regions of those surfaces.

Helmets constructed mainly of flexible materials, with a rigid front window or mask, have already been proposed, the helmet being closed by fastening means extending over the top and down the back of the helmet, and the mask being sealed to the wearer's face by a rubber tube or bladder of approximately annular shape which is inflated by oxygen at a pressure greater than that of the oxygen supplied for breathing purposes: such a helmet must be carefully fitted to each individual wearer, its adjustment being a complex operation, and the pressure differential necessitates a compensatory regulating valve in the oxygen circuit, which makes the helmet complicated and expensive.

The present invention has for its main object to provide an improved pressurized helmet constructed mainly of flexible material, but dispensing with the compensatory or "pressure-drop" valve.

A specific object of the invention is to prevent the accumulation of carbon dioxide in the interior of the helmet, with consequent danger of the wearer inhaling a quantity of that gas which might have become residual during sustained breathing at high altitudes.

A further object of the invention is to divide the space through which the oxygen reaches the wearer's respiratory organs, from the point or points of supply to the helmet, into a plurality of compartments through which the oxygen passes in series, so as to produce a scavenging effect to sweep out any residual carbon dioxide.

Other objects and advantages of the present invention will hereinafter appear from the following description, of two embodiments, with optional modifications of construction, as illustrated in the accompanying drawings; in these drawings—

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Fig. 1 is a part sectional side elevation of the helmet in the first embodiment, parts of the wearer's face being indicated in profile by chain dotted lines.

Fig. 2 is a front elevation of the helmet, the right half of the figure having the front window or mask partly torn away to reveal the internal construction.

Fig. 3 is a detail on a larger scale, showing in section a portion of the partition inserted in the oxygen-space of the helmet.

Figs. 4 to 7 are details corresponding to Fig. 3, with various alternative constructions of the inserted partition.

Fig. 8 is a detail showing a modification of the oxygen inlet to the helmet of Fig. 1.

Fig. 9 is a part-sectional side elevation of the helmet in a second embodiment.

Fig. 10 is a front elevation of the helmet in this embodiment, part of the front window being torn away.

Referring to Figs. 1 and 2 of the drawings, the improved helmet comprises a skin or liner 11 made of flexible material substantially impervious to oxygen under the pressure employed, such as thin sheet rubber, adapted to fit snugly in contact with the wearer's head, the material used being one not liable to cause injury to his skin. This skin 11 substantially encloses the wearer's head and chin, but is formed with a front aperture 12 over his eyes, nose and mouth. The edges 13 of this aperture are sealed to the wearer's face by making light contact therewith at the time of fitting the helmet, the edges being preferably beaded for reinforcement; these edges are subsequently pressed against the face with a self-sealing action by the pressure of oxygen admitted into the helmet, as hereafter explained. A pressure-retaining outer skin or cover 15, also made of flexible and gas-proof material such as sheet rubber or plastic, for example polyvinyl chloride, reinforced with nylon, cotton or other fabric so as to withstand internal pressure and to protect the inner skin 11, surrounds the latter, so that the re-entrant beaded edges 13 are exposed to the oxygen pressure inside the helmet. The oxygen has also free access to the narrow enclosed space 17 between the skin 11 and the cover 15 at the sides and back of the helmet and around its neck portion, the helmet-inflationary pressure in this space 17 being the same as the oxygen-breath pressure so that no differential compensatory or regulatory valve is required.

Both the skin 11 and the cover 15 are cut away at the top, their adjacent edges 15a, 11a being here joined together in a gas-tight manner and connected to a panel 20 of flexible material, such as nylon fabric, which rests upon the crown of the wearer's head. The skin 11 and cover 15 are also slit at the back so as to enable the helmet to be readily fitted in place, the adjacent edges of the skin and cover being joined together in a gas-tight manner, and the opposite sides of the slit being adjustably fastened together, for example by lacing 22 or by a "zip" slidable fastener.

A frontal mask 25, preferably molded of reinforced rubber or plastic material, with an inserted window 26 of transparent plastic or the like, has its edges suitably joined to the cover 15. In the construction illustrated, the cover 15 is shown integral with the frontal mask, the thin rear edges 25a of the latter being continued in sheet form to constitute the cover; it will however be understood that the molded mask 25 and sheet-rubber cover 15 may be formed separately and joined together by vulcanization or otherwise, as the judgment of the manufacturer may dictate. The edges 25a of the frontal mask are attached to the exterior of the liner 11, as clearly seen at the top of Fig. 1, the adjacent edges 11a of the liner being suitably rounded or channelled, in order to improve the contact.

The oxygen supply to the helmet from a feed-tube 29

enters a forked or Y-shaped tube 30 from which two branches 30a extend sideways and are connected by flexible rubber pipes 32 to two inlet fittings 33 mounted upon the cover 15 on opposite sides of its neck portion; through these fittings, the oxygen is admitted, under a pressure of about 2½ pounds per square inch for example, into the narrow space 17 between the inner skin 11 and the cover 15, so that the skin is held in contact with the wearer's head and neck by this oxygen pressure, which at the same time maintains the outer cover 15 inflated against the ambient atmosphere. The purpose of cutting away the top portion of the inflatable helmet, and fitting the flexible panel 20, is to balance the areas at the top and bottom of the helmet which are subject to the internal oxygen pressure, thus preventing the helmet from being raised or lowered in relation to the wearer's head by the oxygen pressure. The oxygen pressure behind the mask 25 acts upon the re-entrant edges 13 of the skin 11, already held in contact by their initial stretch, so as to seal those edges firmly against the wearer's face and prevent any undesired leakage around these edges; a non-return valve of any convenient kind for compensated exhalation is attached to a tubular projection 34 at the bottom of the mask. The usual microphone transmitter is shown diagrammatically at 35, mounted in the mask beneath the window 26; receiving ear-pieces 36 are shown as being fitted in the space 17 between the skin 11 and the cover 15 of the helmet, shock-absorbing material being provided for the sake of comfort and the skin 11 having preferably small holes therein to register with the position of these ear-pieces, so as to allow for pressure-balance across the ears and the respiratory organs, while maintaining the seal. If it should be unnecessary to provide this pressure-balance feature, as in the case of experienced operators, these small holes registering with the position of the ear-pieces may be omitted.

In the pressurized helmet described, the total volume of the enclosed space containing oxygen directly applicable to the wearer's breathing organs may amount to about 2,000 cubic centimeters when the helmet is inflated, but with the oxygen supply delivered adjacent to the frontal mask 25, for example above the level of the wearer's eyes, and the exhalation valve attached to the projection 34 at the bottom of the mask, there would be an excessive amount of "dead space" in which carbon dioxide could accumulate, more particularly in the relatively narrow but still considerable space 17 enclosed between the liner 11 and the cover 15 of the helmet. A reduction of this enclosed space, for example to less than 600 cubic centimeters, would probably remove the danger of accumulation of carbon dioxide, but there are practical difficulties in narrowing the space 17 still further, and also in reducing the distance of the frontal mask 25 from the wearer's face.

According to the invention, therefore, the enclosed space 17 of the pressurized helmet is sub-divided into a plurality of compartments through which the oxygen supply is passed in series so as to produce a scavenging effect, thereby sweeping out any accumulated carbon dioxide towards the tubular projection 34 and the attached exhalation valve, through which it will be discharged by the normal breathing action of the wearer.

In the embodiment illustrated in Figs. 1 to 3, the narrow space 17 between the liner 11 and cover 15 is divided into two compartments by the insertion of a partition consisting of a soft rubber ring 47, this ring being attached to the exterior of the liner 11 and to the interior of the cover 15, as best seen in Fig. 3; the ring 47 extends over the wearer's forehead, down his cheeks and beneath his chin, the intermediate parts on each side being curved rearwardly so as to be clear of the front aperture 12 in the liner. The rubber ring 47, which may be composed of sponge rubber or the like, is conveniently attached to the liner 11 and cover 15 with any suitable adhesive. The non-contacting faces of the rubber ring

47 are covered and sealed by thin sheet-rubber material as at 48; these sealed faces of the ring being substantially impermeable by the oxygen within the helmet, the partition effectually divides the space 17 into front and rear compartments, indicated in Fig. 1 as 17a and 17b respectively, the rear compartment 17b receiving the oxygen supply admitted through the inlet fittings 33, and the front compartment 17a containing a high proportion of oxygen for respiration by the wearer. Restricted passage of oxygen from the rear to the front compartment can take place through two gaps formed in the ring 47, as indicated at 49 in Fig. 2, each of these gaps having a cross-sectional area of about one-fifth of a square inch for example, sufficient to pass the quantity of oxygen required for breathing without material throttling or reduction of pressure.

Thus the supply of oxygen takes the following courses:

(a) From the feed-tube 29, through the forked tube 30 and its branches 30a to the inlet fittings 33 upon the cover 15, and into the rear compartment 17b of the enclosed space;

(b) From the rear compartment 17b, through the gaps 49 in the rubber ring, into the front compartment 17a behind the mask 25, where it sweeps down the window 26 so as to remove condensation;

(c) From the front compartment 17a to the wearer's respiratory organs, his exhalation back into the compartment 17a behind the mask passing out into the atmosphere through the balanced valve at the bottom of the mask.

Since the exhalation takes place into a relatively restricted space represented by the front compartment 17a, carbon dioxide will be swept out of that compartment through the exhalation valve by the fresh oxygen entering in steady streams through the gaps at 49 in the rubber ring, these gaps being of such area that substantially no reverse flow of carbon dioxide into the rear compartment 17a takes place; consequently, the rear compartment will always contain oxygen free from any residual carbon dioxide such as might prove dangerous in the event of accelerated deep breathing by the wearer.

The dividing partition may take other forms than the rubber ring shown in Figs. 1 to 3; for example, Fig. 4 shows a partition in the form of a molded channel-section 51, 52, made of soft rubber, with its opposite flanges 51 attached to the liner 11 and to the cover 15 respectively in a gas-tight manner, as by vulcanization, the web portion 52 of the channel being provided with narrow slits or other apertures 53 to allow passage of oxygen from the rear compartment to the front. If desired, the slits 53 may be arranged to act as non-return valves preventing return of gas to the rear compartment 17b, their edges separating to allow forward flow of oxygen but closing together against flow in the reverse direction. Alternatively, as shown in Fig. 5, the channel-section partition 54 may be substantially impermeable, i. e. made without the slits or apertures 53, the forward flow of oxygen taking place through a pair of transfer tubes 55 on the exterior of the helmet, each tube fitted with a non-return valve 56.

Instead of the channel-section partitions, other forms may be used, such as the Z-section shown at 57 in Figs. 6 and 7, either with slits or apertures 58, as shown in Fig. 6, or without such slits or apertures, as shown in Fig. 7, at least one external transfer tube 59 with a non-return valve 60 being then provided.

The number of compartments into which the enclosed space is divided may obviously be greater than two; for example, as indicated at 61 in Fig. 1, another partition may be provided across the rear compartment 17b, so as to sub-divide the latter into upper and lower compartments. The several compartments so formed will be connected in series, as described with reference to Figs. 1 to 7, for flow of oxygen from the supply so

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that it eventually reaches the front compartment 17a wherein respiration takes place.

On the other hand, the oxygen supply may be connected to the rear or lower compartment by a single pipe 30 instead of the two branches and pipes 32, as above described. According to a modification, illustrated in Fig. 8, the oxygen supply from the feed-tube 29 enters a hollow boss 62 molded on the exterior of the mask 25 adjacent to the bottom projection 34; from the cavity inside this boss, one or more channels 63 extend through the material to the space 17 enclosed between the skin 11 and cover 15, directly in front of the wearer's throat. The transfer from one compartment to the next in the series may take place through a single gap, slit or aperture in the partition, or through a single external transfer pipe 55, instead of the several such devices as in the embodiment above described.

Figs. 9 and 10 illustrate an alternative embodiment, in which a further reduction of the "dead space" inside the helmet is secured by providing an internal mouth-piece or breathing mask which fits closely over the wearer's nose and mouth, with the oxygen flowing from the rear compartment of the helmet into the front one and entering the breathing mask, through one or more non-return valves housed thereon, to reach the wearer's nose and mouth. Exhalation takes place beneath the same mask into the bottom of the helmet, where there is housed a compensated exhalation valve of any convenient kind.

The provision of the internal mouth-piece or mask and the maintenance of the systematic oxygen circuit described above eliminate the possible misting of the transparent window panel in the frontal mask, due to condensation of moisture from the breath of the wearer; the oxygen flowing into the front compartment sweeps down behind the window and effectively removes the moisture.

The internal mouth-piece or breathing mask 64, which may be combined with the frontal mask 25 in the course of manufacture, or molded separately of a suitable rubber compound and attached to the frontal mask by vulcanization or the like, is shaped to fit over the wearer's nose and beneath his chin, the edges being preferably beaded for reinforcement; as best seen in Fig. 10, the frontal mask 25 is formed with a central hump 25b merging into the mouth-piece or breathing mask 64, the window 26 being accordingly reduced in height at its middle but retaining its full depth in front of the wearer's eyes so as not to restrict his vision. On each side of the nose, the rear edge 65 of the mouth-piece or breathing mask presses lightly against the wearer's cheek and the skin or liner 11, this edge being curved substantially as shown in Fig. 9 so as to connect with the lower part beneath the chin, where the rear edge lies just clear of the partition ring 47. At the lower part of the frontal mask 25, a housing 66 for the exhalation valve 67 is provided, communicating with the interior of the breathing mask 64.

The oxygen supply from a feed tube 68 passes to the rear compartment 17b of the helmet through one or more connectors 69, mounted on the cover 15, or through one or more molded channels as described with reference to Fig. 8; through these fittings the oxygen is admitted, under a pressure of about 2½ pounds per square inch for example, into the rear compartment 17b of the space between the inner skin 11 and the cover 15. Oxygen from the compartment 17b passes upwards and through the gaps 49 in the dividing partition 47 into the front compartment 17a, and into the space between the frontal mask 25 and the wearer's face, sweeping downwards behind the window 26. From this space, the oxygen passes into the breathing mask 64 by way of the two non-return valves 70, to reach the wearer's respiratory organs, from which it is exhaled together with

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carbon dioxide and water vapor into the atmosphere through the exhalation valve 67 of the helmet.

It will be noted that with the second embodiment, shown in Figs. 9 and 10, the "dead space" inside the helmet is substantially restricted to the interior of the mouth-piece or breathing mask 64, so that the risk of accumulation of carbon dioxide is quite negligible. The position of the internal mouth-piece or breathing mask in relation to the helmet is substantially fixed either by the method of combining it with the frontal mask 25 in manufacture, or by its attachment thereto and the use of a common outlet housing 66 if it is molded separately, as well as by the engagement of its rear edge beneath the chin-portion of the skin 11; this breathing mask is therefore stabilized inside the helmet, but, in addition, thin rubber bands 78 are attached to the outer surface of the mask 64, over the side edges 65, the other ends of these bands being connected to the dividing partition 47 so as to give an even pull on both sides of the mask. The stabilizing bands 78 will thus maintain the edges of the breathing mask in light contact with the wearer's nose and cheeks, irrespective of the oxygen pressure, so that the mask is effectively sealed against leakage but presents little or no difficulty when fitting the helmet in place upon the head or when removing it after use.

The other parts of the helmet may be arranged as in the said first embodiment, the microphone 35 being mounted beneath the breathing mask 64 and the ear-pieces 36 on the inside of the cover 15.

As described in our aforesaid pending application, the entire helmet, with the exception of the frontal mask 25 and the neck portion, may be covered with nylon fabric or the like, with lacing at the sides and over the crown for purposes of individual adjustment; this outer covering or hood will be slotted at the back, over the slit edges of the skin 11 and cover 15, the slot being provided with suitable fastening means. The purpose of this outer covering or hood is mainly to resist the internal oxygen pressure and thus to prevent undue swelling of the helmet upon inflation; it also serves to restrict its external size and shape, so that it will conform more closely to the wearer's head and thereby enable the inner skin 11 to maintain close contact with the head.

It will be understood that various modifications may be made in the construction of the pressurized helmet, without departing from the spirit and scope of the present invention as defined in the appended claims.

What we claim is:

1. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, means for admitting said oxygen supply to said narrow space for holding said skin in contact with the wearer's head and for inflating said cover, and a partition dividing said narrow space between said skin and cover to form a plurality of compartments through which said oxygen supply flows in series.

2. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, means for admitting said oxygen supply to said narrow space for holding said skin in contact with the wearer's head and for inflating said cover, a partition dividing said narrow space to form a plurality of compartments, and means for restricted flow of oxygen from one to another of said compartments.

3. In a pressurized helmet of the kind described, and

associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, the edges of the aperture in said skin being maintained in light contact with the wearer's face around said organs by initial stretch of the skin material, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, means for admitting said oxygen supply to said narrow space for holding said skin in contact with the wearer's head and for inflating said cover, and a partition dividing said narrow space to form a plurality of compartments, said partition being apertured for restricted flow of oxygen from one to another of said compartments.

4. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, the edges of the aperture in said skin being maintained in light contact with the wearer's face around said organs by initial stretch of the skin material, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, means for admitting said oxygen supply to said narrow space for holding said skin in contact with the wearer's head and for inflating said cover, a partition dividing said narrow space to form a plurality of compartments, and valve means for flow of oxygen from one to another of said compartments in a direction towards the aperture in said skin exposing the wearer's respiratory organs.

5. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, a partition dividing said narrow space to form a plurality of compartments, one of said compartments affording direct communication with the wearer's respiratory organs exposed by the aperture in said skin, and means for admitting said oxygen supply to another of said compartments, said partition being apertured for restricted flow of oxygen from said one to said other of said compartments.

6. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, a partition dividing said narrow space between said skin and cover to form a plurality of compartments, one of said compartments affording direct communication with the wearer's respiratory organs exposed by the aperture in said skin, means admitting said oxygen supply to another of said compartments, and valve means for flow of oxygen from said one compartment to said other compartment.

7. In an aviator's helmet provided with a supply of oxygen under pressure, the combination of a flexible skin shaped to fit the aviator's head, said skin being apertured to expose his respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, means for dividing said narrow space to form a plurality of compartments, one of said compartments affording direct communication with the aviator's respiratory organs exposed by the aperture in said skin, another of said compartments adapted to receive said oxygen supply, and means for restricted flow of oxygen from said one compartment to said other compartment.

8. In an aviator's helmet provided with a supply of oxygen under pressure, the combination of a flexible skin shaped to fit the aviator's head, said skin being apertured to expose his respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, means for dividing said narrow space to form a plurality of compartments, one of said compartments affording direct communication with the aviator's respiratory organs exposed by the aperture in said skin, another of said compartments adapted to receive said oxygen supply, and valve means for flow of oxygen from said one compartment to said other compartment.

9. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, the edges of the aperture in said skin being held in light contact with the wearer's face around said organs by tension of the skin material, and a partition dividing said narrow space to form a plurality of compartments, one of said compartments receiving said oxygen supply, and said partition consisting of a soft rubber ring substantially impermeable by the oxygen within the helmet but being interrupted by at least one gap of small cross-sectional area sufficient to pass from said one compartment to another compartment the quantity of oxygen required for breathing by the wearer.

10. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, said skin being held in contact with the wearer's head by the pressure of said oxygen supply, and a partition dividing said narrow space to form a plurality of compartments, one of said compartments receiving said oxygen supply, and said partition consisting of a molded rubber ring having a web portion apertured for restricted flow of oxygen from said one compartment to another of said compartments.

11. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, said skin being held in contact with the wearer's head by the pressure of said oxygen supply, and a plurality of partitions dividing said narrow space to form several compartments, one of said compartments receiving said oxygen supply, and said partitions being apertured for restricted flow of oxygen from said one compartment to the others of said compartments in series.

12. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, said skin being held in contact with the wearer's head by the pressure of said oxygen supply, a frontal mask molded integrally with said cover, and a partition dividing said narrow space to form a plurality of compartments, one of said compartments receiving said oxygen supply, and said partition being apertured for restricted flow of oxygen from said one compartment to said other compartment.

gen from said one compartment to another of said compartments.

13. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner, a breathing mask within said cover and over the aperture in said skin, said breathing mask fitting closely over the wearer's nose and mouth, means for admitting said oxygen supply to the interior of said cover, and means for restricted flow of oxygen from said cover into the interior of said breathing mask, said skin being held in contact with the wearer's head and face by the pressure of oxygen within said cover.

14. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's eyes, nose and mouth, the edges of the aperture in said skin being maintained in contact with the wearer's face by initial stretch of the material of said skin, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner, an internal breathing mask mounted within said cover, said breathing mask fitting closely over the wearer's nose and mouth and within the aperture in said skin, means for admitting said oxygen supply to the interior of said cover, means for restricted flow of oxygen from said cover into the interior of said breathing mask, and means for exhaust of the wearer's breath from the interior of said breathing mask, said skin being held in contact with the wearer's head and face by the pressure of oxygen within said cover.

15. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's eyes, nose and mouth, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner, a frontal mask integral with said cover, said frontal mask including a transparent panel in front of the wearer's eyes, an internal breathing mask mounted within said cover, said breathing mask fitting closely over the wearer's nose and mouth and partly over the aperture in said skin, means for admitting said oxygen supply to the interior of said cover, means for restricted flow of oxygen from said cover into the interior of said breathing mask, and means for exhaust of the wearer's breath from the interior of said breathing mask, said skin being held in contact with the wearer's head and face by the pressure of oxygen within said cover, and said oxygen-admitting and oxygen-flow means being so located that the oxygen sweeps downwardly over the inner surface of the transparent panel in said frontal mask.

16. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's eyes, nose and mouth, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, a partition dividing said narrow space to form a plurality of compartments, a breathing mask mounted within one of said compartments, said breathing mask fitting closely over the wearer's nose and mouth and within the aperture in said skin, means for admitting said oxygen supply to another of said compartments, said partition being apertured for restricted flow of oxygen between said compartments, means for restricted flow of oxygen from said one compartment into the interior of

said breathing mask, and means for exhaust of the wearer's breath from the interior of said breathing mask, said skin being held in contact with the wearer's head and face by the pressure of oxygen within said one compartment.

17. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, a partition dividing said narrow space to form front and rear compartments, said front compartment affording direct communication with the wearer's respiratory organs exposed by the aperture in said skin, and means for admitting said oxygen supply to said rear compartment, said partition being apertured for restricted flow of oxygen from said rear compartment to said front compartment.

18. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, a partition dividing said narrow space to form front and rear compartments, a breathing mask within said front compartment, said breathing mask covering the wearer's nose and mouth and making contact with his face around the nose and mouth, means for admitting said oxygen supply to said rear compartment, said partition being apertured for restricted flow of oxygen from said rear compartment to said front compartment, and valve means for flow of oxygen from said front compartment into the interior of said breathing mask, and means for holding said breathing mask in sealing contact with the wearer's face, said skin being held in contact with the wearer's head and face by the pressure of oxygen in said compartments.

19. In a pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, the combination of a skin shaped to fit the wearer's head, said skin being apertured to expose the wearer's respiratory organs, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, a breathing mask within said cover and over the aperture in said skin, said breathing mask fitting closely over the wearer's nose and mouth, means for holding said breathing mask in position within said cover, so as to receive a supply to the oxygen under pressure to the interior of said cover, and means for restricted flow of oxygen from said cover into the said narrow space, said skin being held in contact with the wearer's head and face by the pressure of oxygen within said cover.

20. A pressurized helmet of the kind described, and associated with means for supply of oxygen under pressure, comprising in combination a skin shaped to fit the wearer's head, said skin being made of thin sheet rubber and apertured to expose the wearer's eyes, nose and mouth, the edges of the aperture in said skin being maintained in light engagement with the wearer's face around his eyes, nose and mouth by initial stretch of said rubber, said skin being held in contact with the wearer's head by the pressure of said oxygen supply, a flexible cover loosely enclosing said skin, said skin and cover being joined together in a gas-tight manner to enclose a narrow space between them, and a partition dividing said narrow space to form a plurality of compartments through which said oxygen supply flows in series to reach the wearer's nose and mouth exposed by the aperture in said skin.

No references cited.