April 19, 1949. J. D. AKERMAN 2,467,364

AVIATOR'S PRESSURE VEST

Filed July 9, 1947 2 Sheets-Sheet 1

FIG. 1

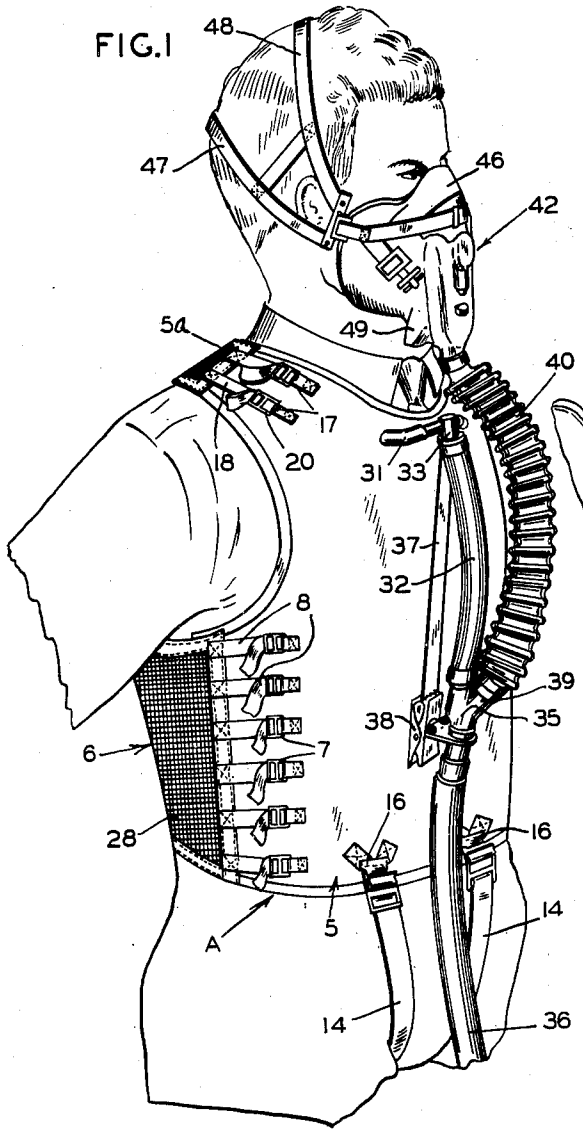

FIG. 2

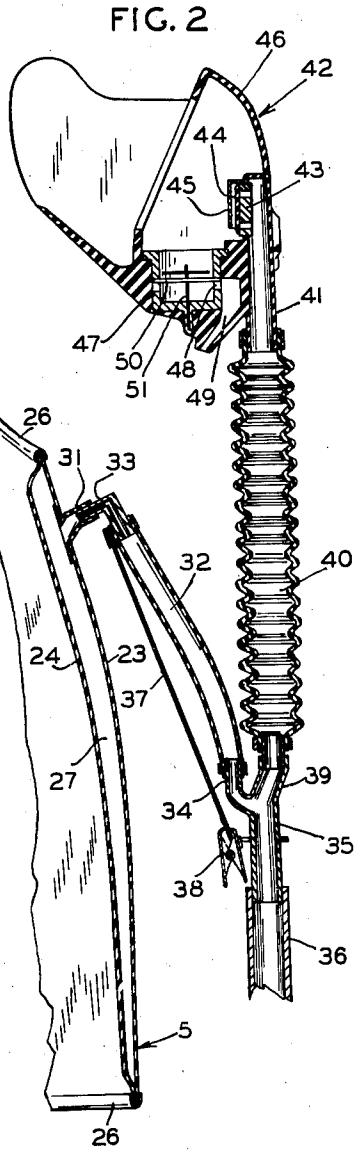

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FIG. 3

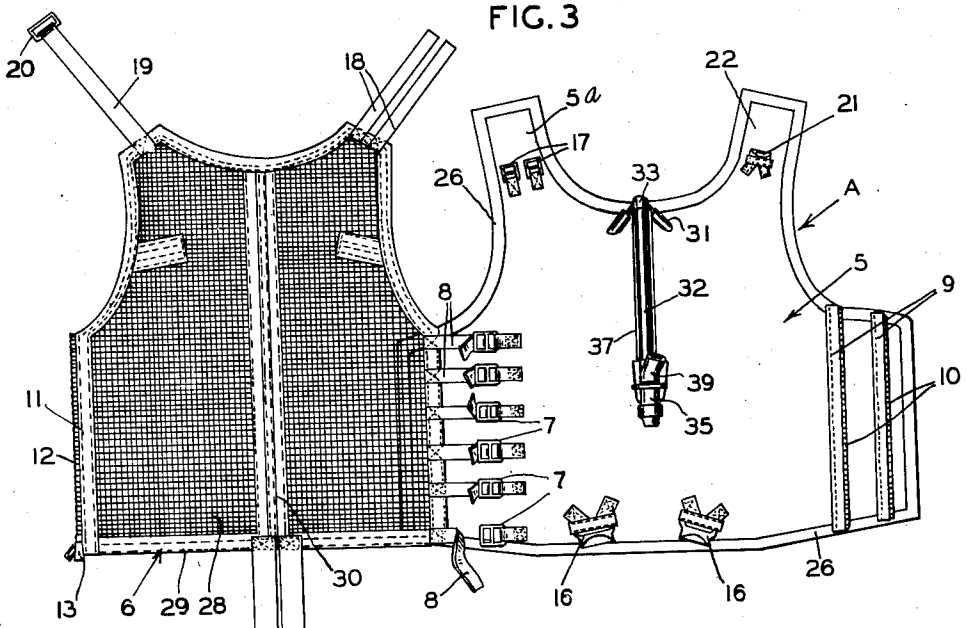
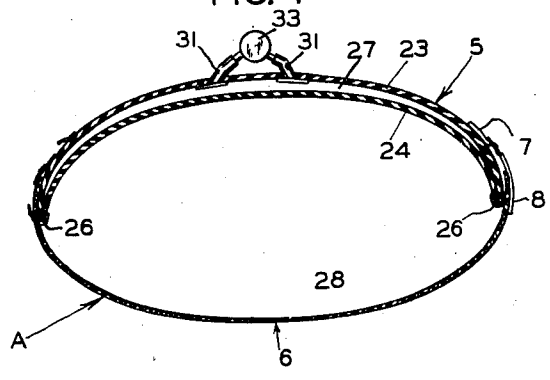


FIG. 4



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AVIATOR'S PRESSURE VEST

John D. Akerman, Minneapolis, Minn.

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9 Claims. (Cl. 128—142)

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This invention relates to high altitude flying apparatus and more particularly to a combined pressure vest and oxygen mask wherein the pressure exerted on the chest of the wearer is automatically balanced in relation to varying pressures in the lungs of the wearer as he breathes.

It is an object of the invention to provide apparatus including a pressurized vest or chest engaging garment and a user demand oxygen mask with flow connections between the pressure chamber of the vest and the oxygen supply structure of the mask so that inhalation with its accompanying increase in pressure in the lungs results in a compensating pressure reduction in the pressure chamber of the vest.

Another object of the invention is to provide apparatus of the type described above which can be advantageously used at high altitudes and wherein the pressure exerted by the vest against the chest of the wearer compensates for the reduced atmospheric pressure found at high altitudes, and the pressure balancing feature described above facilitates normal lung and chest action and greatly increases the comfort and efficiency of the user.

Another object of the invention is to provide a light-weight and comfortable pressure vest structure which permits freedom of movement on the part of the user and which is so constructed that it can be quickly and easily fitted to people of different sizes.

The above objects and advantages of the invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same parts throughout the views, and, in which:

Figure 1 is a perspective view of the apparatus shown on the upper trunk and face portions of a person;

Figure 2 is an enlarged vertical sectional view through the apparatus with portions of the vest broken away;

Figure 3 is a plan view of the vest per se and placed out flat to show the front and rear portions thereof; and

Figure 4 is a horizontal sectional view through the vest.

In Figures 1 and 3 there is shown a vest A, including a front portion 5 and a rear portion 6. The front and rear portions are separate structures which are detachably connected at several points. At one side of the vest front 5 is a vertically disposed row of buckles 7 which are adapted to removably receive a vertically

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disposed row of short straps 8, said straps being connected to one side of the vest back 6.

The other side of vest front 5 is provided with a pair of laterally spaced slide fastener tape elements 9 which have the usual fastener jaws or gripping elements 10 mounted thereon. On the opposite side of the vest back 6 is a slide fastener tape 11 having gripper elements 12 thereon. A slide member 13 is slidably mounted on the tape 11 and is adapted to interconnect the grippers 12 on the tape 11 with either of the sets of grippers 10 on either of the tapes 9. This provides a readily adjustable connector which is capable of securing the vest in two rather widely adjusted sizes. The slide fastener connections supplemented by the buckles 7 and straps 8 permit fitting and close adjustment of the vest within a considerable range of sizes.

Extending downwardly from the lower center portion of the rear vest section 6 are straps 14 having loop buckles 15 on their ends. The straps 14 are adapted to pass inwardly beneath the crotch of the wearer and the looped buckles 15 are removably fastened on suitable hooks 16 on the lower forward portion of the front vest section 5.

The front vest section 5 has a shoulder portion 5a on which is mounted a pair of buckles 17 which are adapted to detachably connect with a pair of straps 18 on the adjacent shoulder portion of the rear vest section 6. Similarly the opposite shoulder portion of the rear vest section is provided with a strap 19 carrying a loop 20 which is adapted to removably engage and hook 21 on the other front vest section shoulder portion 22.

As best shown in the Figures 2 and 4, the front vest section 5 is formed from two layers 23 and 24 of a gas impervious material. The layers are connected at their edges by means of a binding tape 26 which may be secured by means of an adhesive, stitching and adhesive or other suitable sealing means. Consequently there is a chamber 27 which is substantially closed and which provides a pressure chamber between the gas-tight layers 23 and 24.

The rear vest section 6 is formed preferably from a relatively open mesh fabric 28 which may be suitably provided with a binding 29 about its edge and a vertically central reinforcing tape or tapes 30.

The upper forward portion of the front vest section 5 is provided with a pair of conduits 31 which communicate with the internal pressure chamber 27 and connect the latter to an external downwardly extending oxygen supply

conduit 32 through the medium of a forked connection indicated generally at 33. The conduit 32 is connected to an arm 34 of a Y connection 35 whose lower conduit portion is shown connected to an oxygen supply tube 36 which in turn leads to a suitable oxygen supply tank (not shown).

Suspended from the upper Y connection 33 is a strap 37. Fastened to the Y connection unit 35 is a spring clamp element 38 which can be secured to the strap 37 so that the weight imposed upon the connection 35 is transmitted to the upper portion of the front vest section and in turn transmitted to the shoulder portions of the vest.

The lower Y connection 35 is provided with a second upwardly extending branch 39 to which is connected a flexible conduit 40. The upper end of the conduit 40 is connected to an inlet 41 on an oxygen mask indicated generally at 42. The upper end of the mask inlet conduit 41 is provided with an apertured plug 43 which has a flat left hand vertical side as viewed in Figure 2. Against the valve seat element 43 is a loosely supported rubber disc 44 which serves as a valve head. The rubber valve head 44 is loosely contained in a cage 45 which is supported by the upper portion of the inlet conduit 41. The valve structure which is described permits flow of oxygen upwardly through the conduit 41 and apertured valve seat 43 past the valve head element 44 when the user draws breath into the lungs.

The oxygen inlet conduit 41 is supported by a nose and mouth enclosing casing 46 to which are secured suitable head straps 47 and 48 which are adapted to hold the mask against the face of the user.

In the lower portion of the mask body or casing 46 and behind the oxygen inlet conduit 41 is an outlet valve casing 47 which has an open upper portion and one or more side wall openings 48. The opening 48 shown in Figure 2 communicates with an exhaust conduit 49 which leads to the atmosphere outside of the mask 42.

In the valve casing 47 is a movable valve diaphragm 50 mounted on a guide rod 51. The valve diaphragm 50 is light enough so that it will move upwardly and close the outlet opening 48 when the user inhales but will readily drop down when the user exhales and permit the exhalation to flow from the mask through the opening 48 and outlet or exhaust conduit 49 to the atmosphere.

The general arrangement of the mask unit is shown but details are not included since the structure represents a commonly known style of user-demand oxygen mask.

Mounting of the apparatus on the user is thought to be apparent from the drawing and the foregoing description. It might be noted that the strap 37 which was stated to support the lower Y connection 35, also serves as a support for the flexible conduit 40 which leads to the mask 42, thereby preventing downward drag or weight on the mask.

When the apparatus is installed on the user it is intended to be connected with a supply of oxygen so that the user can fly at altitudes where the oxygen content of the air is insufficient to support life. The vest unit is intended to create pressure against the chest of the wearer to compensate for reduced atmospheric pressure at high altitudes and the entire apparatus is designed to facilitate breathing at such altitudes.

The apparatus as best shown in Figure 2 will supply oxygen through the conduit 36 to the interior of the pressure chamber 27 in the front section 5 of the vest and also through the upwardly extending conduit 40 to the inlet side of the apertured valve seat 43 in the mask 42. When the user inhales, oxygen will be drawn through the valve into 33, 34 and into the user's lungs. At the time of inhalation there is a chest expansion. The inhalation will reduce oxygen pressure in the chamber 27 of the vest but the chest expansion will tend to press the inner layer 24 of the vest outwardly toward the outer layer 23 and as a result the chest pressure created by the vest will be maintained in equilibrium. As the user exhales the valve element 44 will close the oxygen supply in the mask 42 and exhaust the spent breath through the exhaust valve outlets 48 and 49. The chest will contract at the same time and additional oxygen will be supplied to the vest pressure chamber 27 from the supply conduit 36.

As a result of the apparatus shown and described, a person can fly at extremely high altitudes with safety and the apparatus is such that he has considerable freedom of movement of his arms and body. As set forth above, the tightly fitting vest unit creates a pressure on the chest which off-sets the reduced atmospheric pressure and particular association of the breathing mask and the vest pressure chamber provide for maintenance of the proper pressure against the chest even though there is a fluctuating lung pressure accompanied by chest expansion and contraction as the user breathes in a normal manner. This exact control and equalizer of pressure is highly important and it permits the user to fly at high altitudes as mentioned above, with the least inconvenience and the highest degree of efficiency.

It will of course be understood that various changes can be made in form, details, arrangement, and proportions of the various parts of my apparatus without departing from the scope of my invention.

What I claim is:

1. High altitude breathing apparatus including, a compressible chamber unit, means on said unit for mounting it closely against the chest of the wearer, an oxygen supply conduit on said unit and communicating with the interior of the chamber of said unit, and a breathing attachment having a flow connection with the interior of said chamber.

2. High altitude breathing apparatus including, a compressible chamber unit, means on said unit for mounting it closely against the chest of the wearer, an oxygen supply conduit on said unit and communicating with the interior of the chamber of said unit, a breathing attachment having a flow connection with the interior of said chamber, said breathing attachment having a one-way intake valve operable to open said flow connection between said chamber and said breathing attachment upon the inhalation demand of the user, and said attachment including a one-way exhaust valve operable oppositely to said intake valve.

3. High altitude breathing apparatus including, a compressible chamber unit having means for securing it closely against the chest of the wearer, an oxygen supply conduit in free flow communication with the interior of the chamber in said unit, and a breathing attachment having a flow connection with the interior of said chamber.

4. High altitude breathing apparatus including, a compressible chamber unit, securing struc-

ture for said unit adapted to embrace the upper trunk portion of the wearer, whereby expansion of the wearer's chest will exert pressure on said chamber unit, an oxygen supply conduit on said unit and communicating with the interior of said compressible chamber, a breathing attachment having a flow connection with the interior of said chamber, and a valve in said flow connection, said valve being normally closed and operable to open upon inhalation demand of the user and substantially coincident with expansion of the chest of the user.

5. High altitude breathing apparatus including, a chest-like garment having a compressible front portion adapted to fit closely against the chest of the user and comprising a pressure chamber, an oxygen supply conduit on said unit adapted for connection with a source of oxygen under pressure and communicating with the interior of said pressure chamber, a breathing attachment having a flow connection with the interior of said pressure chamber, and said breathing attachment including an intake valve operable to open said flow connection upon the inhalation demand of the user, whereby the pressure drop in said pressure chamber produced by inhalation is simultaneously offset by the chest expansion of the user and the pressure in said pressure chamber thereby substantially balanced.

6. High altitude breathing apparatus including, a vest-like garment having a front portion comprising a compressible pressure chamber adapted to lie closely against the chest of the

user, said garment having a relatively open back portion, a fluid inlet connection on said pressure chamber and communicating with the interior thereof, a breathing attachment connection communicating with said fluid inlet connection and extending upwardly therefrom, and a support extending from a point on said garment and supporting the lower portion of said breathing attachment connection.

7. High altitude breathing apparatus including, a vest-like garment having a compressible chest engaging front portion and a back portion, said front and back portions being separated at adjacent sides thereof, and structure releasably and adjustably connecting said adjacent sides of said front and back portions.

8. The structure in claim 7, and the connection between said adjacent sides of said front and back portions including a hookless fastener member on one of said portions and a pair of vertically disposed and laterally spaced complementary hookless fastener members on said other vest portion.

9. High altitude breathing apparatus including, a vest-like garment having a front portion comprising a compressible pressure chamber adapted to lie closely against the chest of the user, a back portion connected to said pressure chamber portion, and a crotch strap detachably connecting said front and back portions.

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No references cited.