April 24, 1962 L. F. SHEPARD 3,030,626

OMNI-DIRECTIONAL HIGH ALTITUDE HELMET

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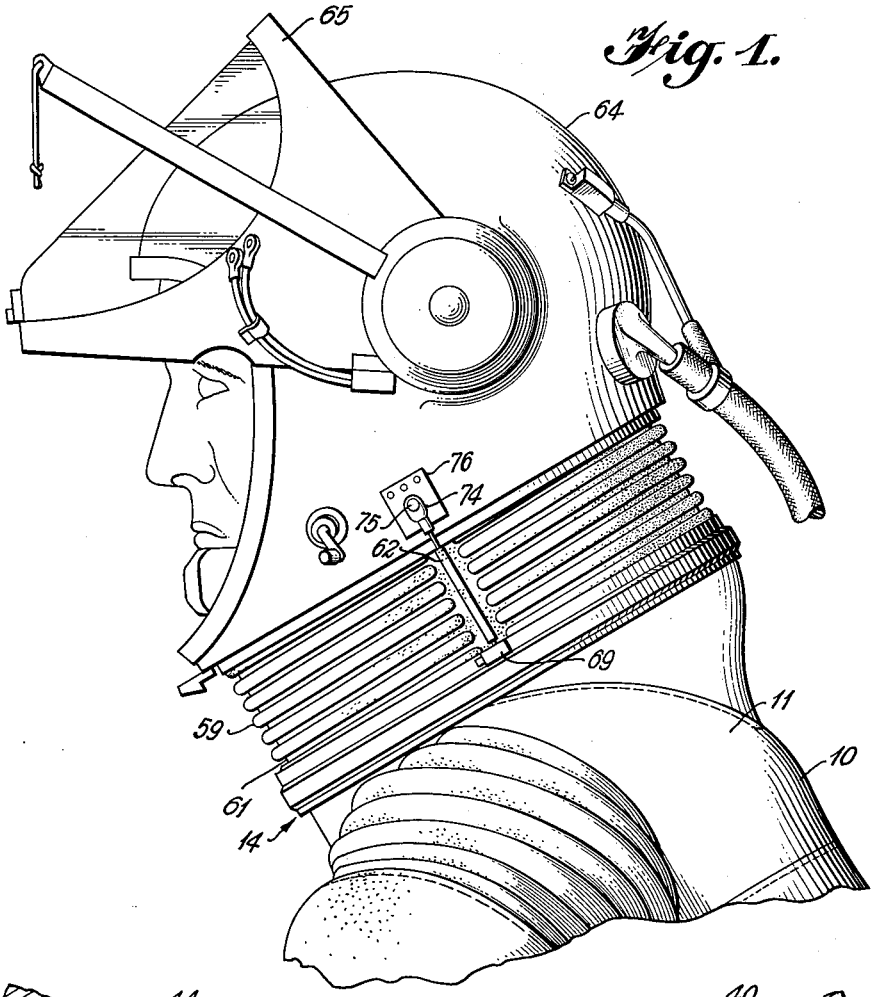
Fig. 1.



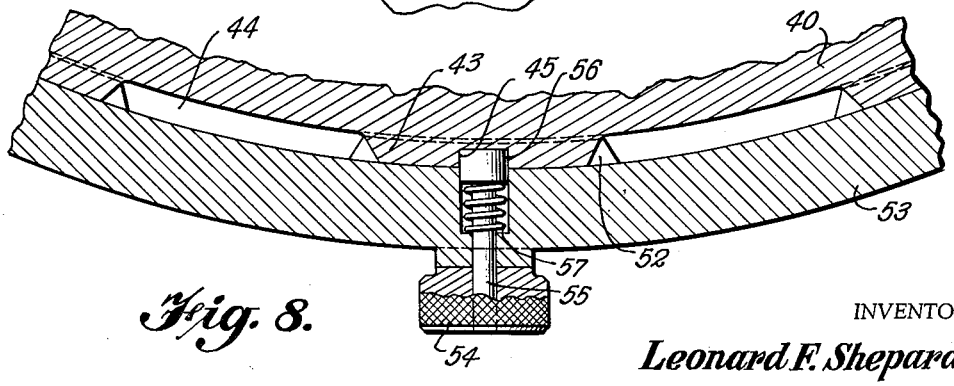


Fig. 8.

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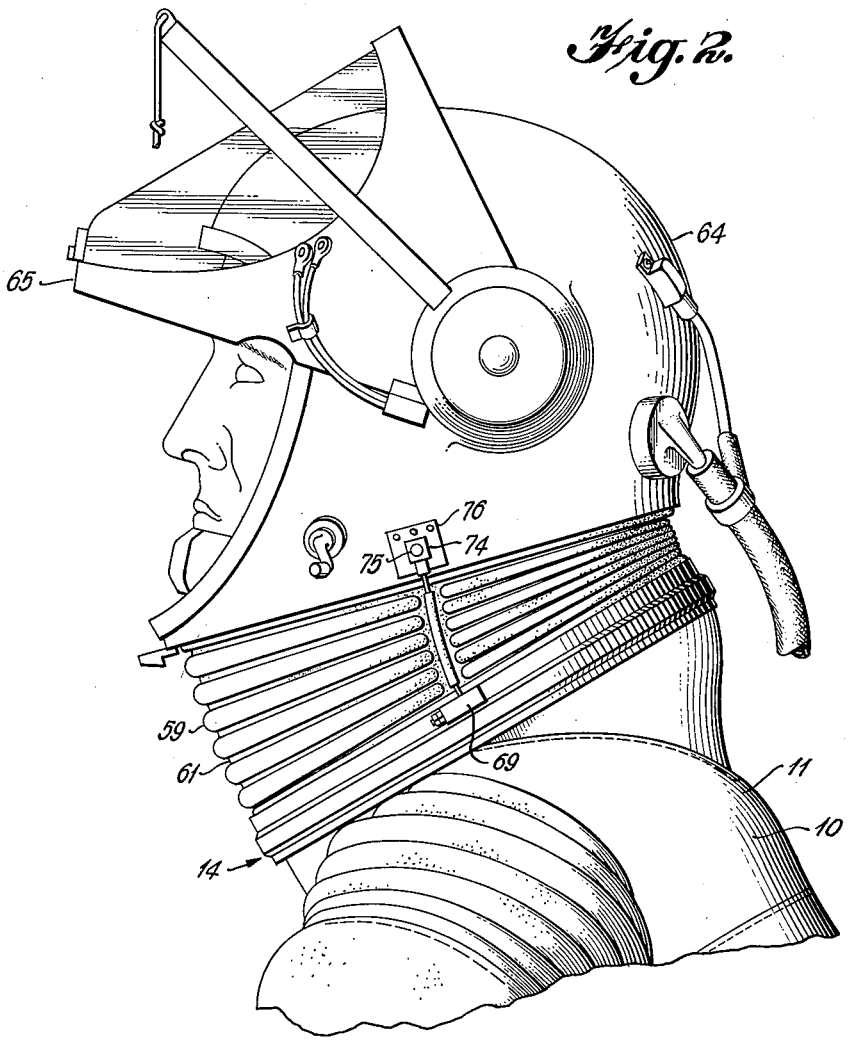
Fig. 2.



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OMNI-DIRECTIONAL HIGH ALTITUDE HELMET

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Fig. 3.

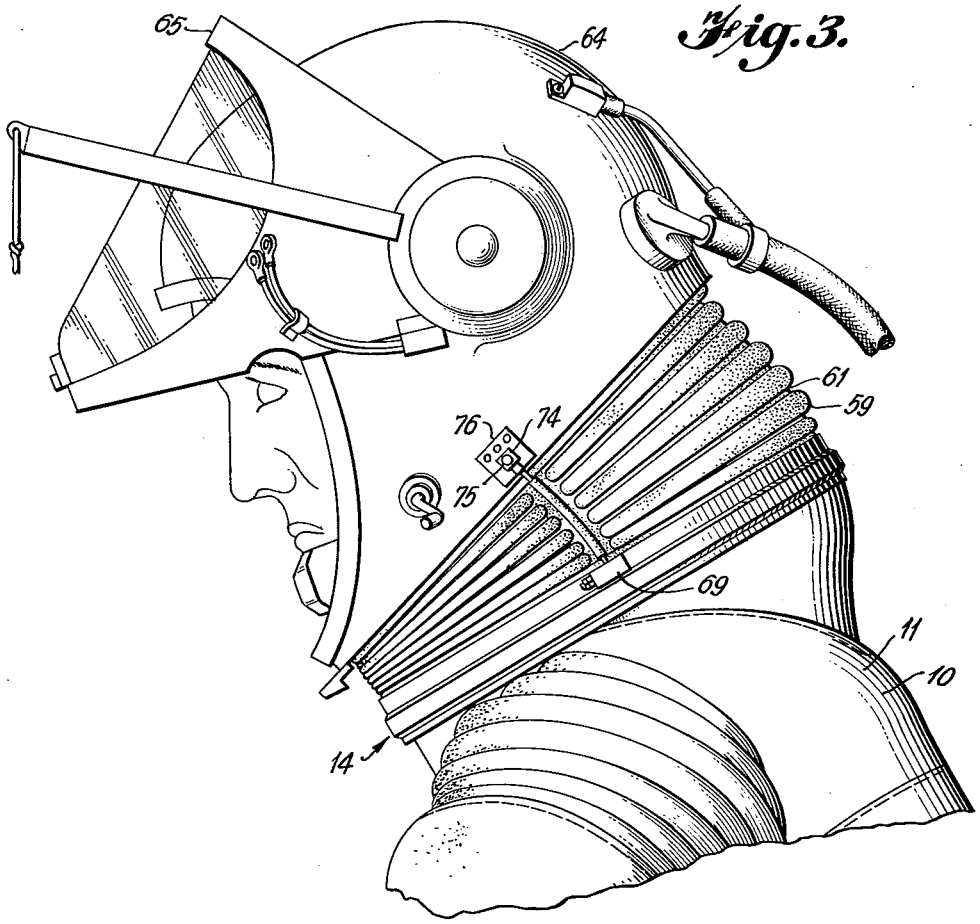

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Fig. 4.

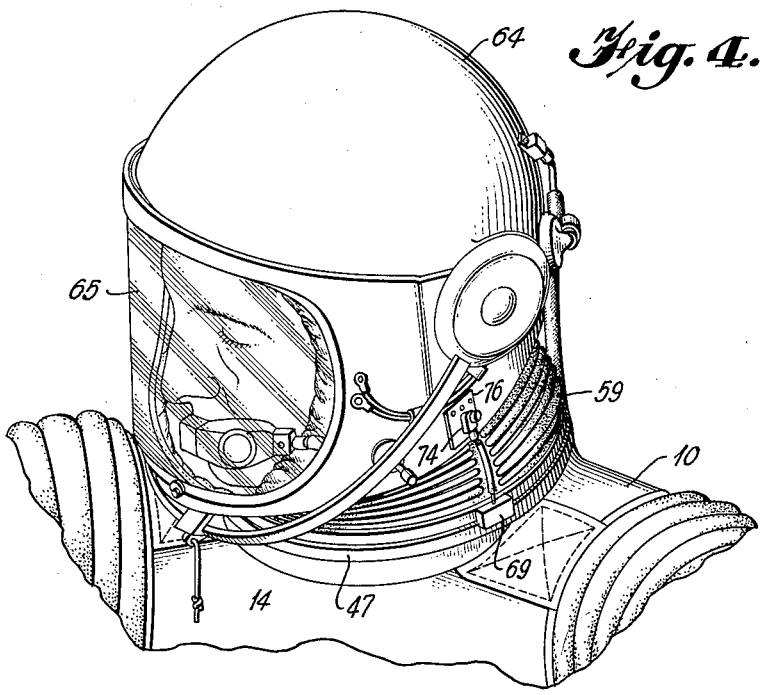
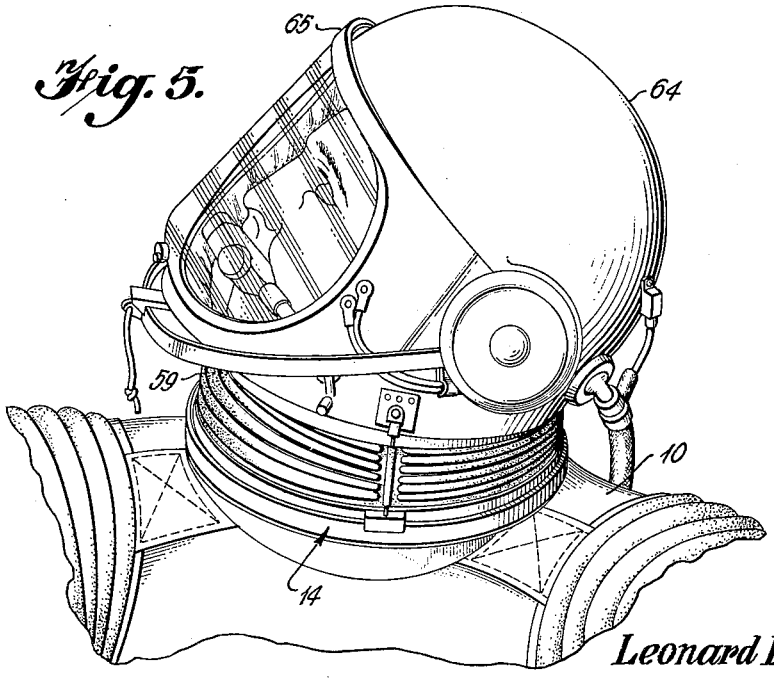


Fig. 5.



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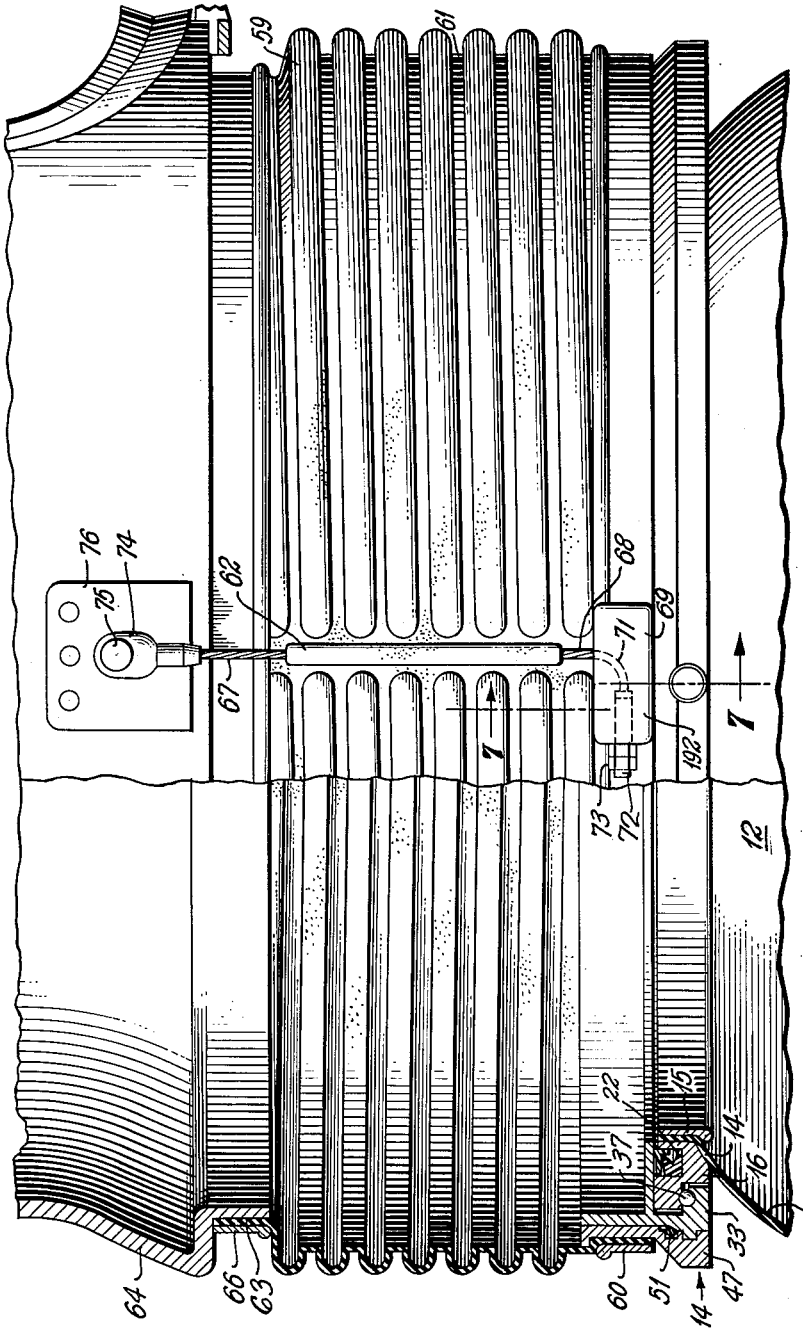

Fig. 6.

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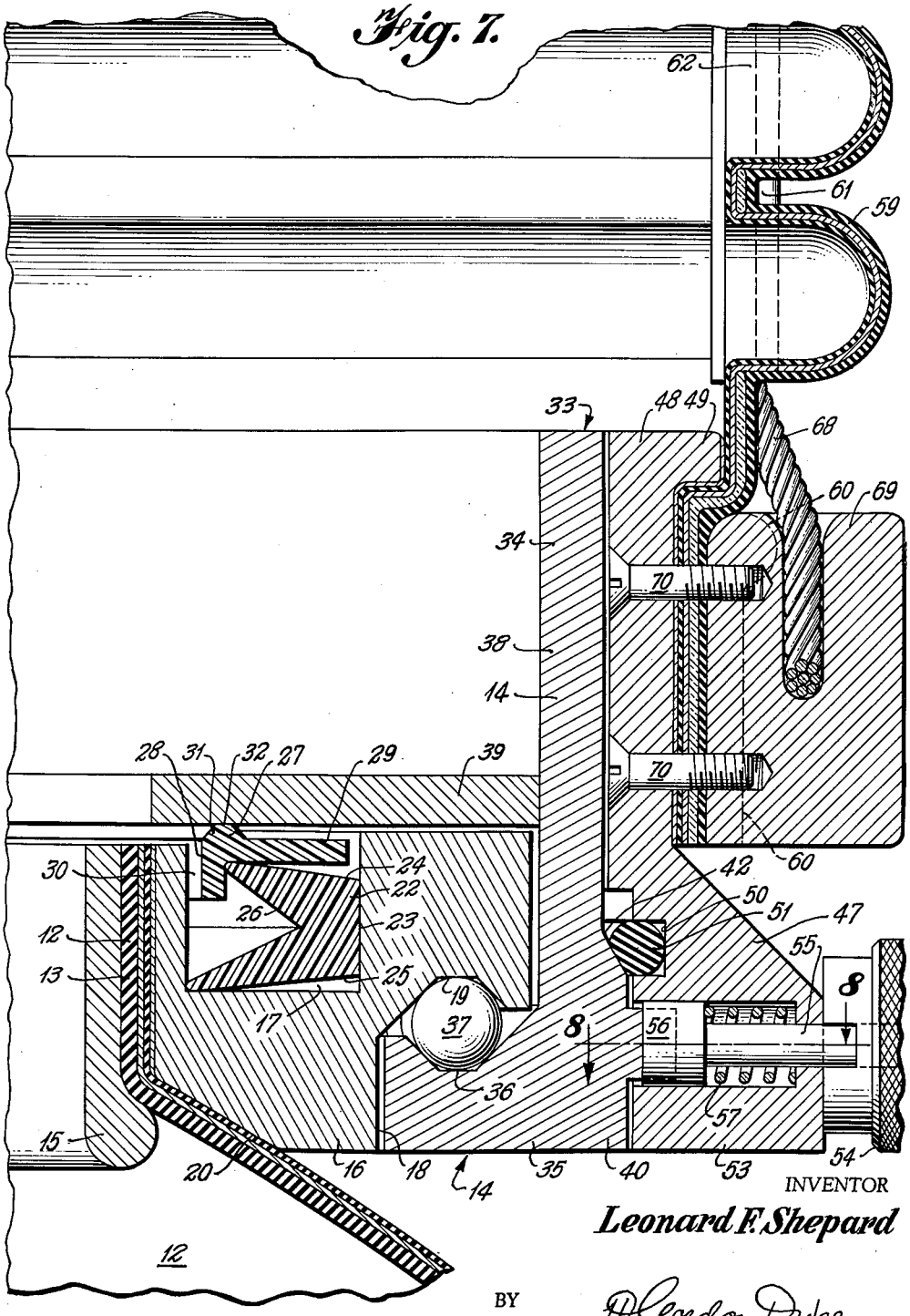
Fig. 7.



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3,030,626

OMNI-DIRECTIONAL HIGH ALTITUDE HELMET

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Filed Dec. 23, 1958, Ser. No. 782,529
2 Claims. (Cl. 2—2.1)

This invention relates to an improvement in pressure suits for high altitude flying. More particularly, the invention relates to an omni-directional helmet for a high altitude flying suit which permits a full range of head motion by the wearer.

During high altitude flying, the personnel of the aircraft must be protected from loss of oxygen by the use of inflatable pressure suits. To assure safety of the personnel and the aircraft, the helmets of the suits must be constructed so that the wearer has at all times the maximum degree of view of the surroundings in the cabin and craft, such as freedom of head movement.

The present invention provides the maximum degree of viewing by assuring the wearer complete and normal head movement. This full range of head movement is provided by a rotatable neck seal positioned at the base of the neck. Secured to the rotatable neck seal is one end of a stabilized bellows with its axis of orientation parallel with the ears when in position around the neck of the wearer. The top marginal edge of the bellows is sealed to a bottom opening in the helmet which encases the head of the wearer. The stabilized bellows allows for controlled upward and downward movement of the helmet while the rotatable neck seal allows for rotation. Thus, anterior-posterior planes are made to coincide with the lateral axis of the head throughout normal and angular displacement of the neck.

The rotatable neck seal can be formed advantageously from two locking rings adapted to rotate with respect to each other, one attached to a neck opening of the suit at the base of the neck and the other to the lower marginal edge of the stabilized bellows surrounding the neck. Either of the rings can be provided with a rotatable pressure seal capable of maintaining the pressure in the suit during rotation of the neck bellows and helmet. The stabilized neck bellows can be in the form of a flexible hollow cylinder with its wall having an indentation in the form of a low pitched helix to facilitate bending action of the bellows. To stabilize the bellows against uncontrolled motion, vertical stabilization wires can be provided on each side of the bellows substantially parallel to the ears. The top marginal edge of the neck bellows is attached to a bottom opening in the helmet and stabilization wires extending from the bellows at the top can be secured to the helmet. In like manner, the wires extending from the bottom of the bellows can be attached to the rotatable neck seal so that, as the helmet and the bellows are rotated clockwise or counterclockwise with the movement of the head of the wearer, the stabilization wires always remain in the same position with respect to the head of the wearer.

The rotatable neck seal can be formed advantageously from two attaching rings, one sealed to the neck opening and the other sealed to the bottom marginal edge of the bellows to provide a means for locking the two rings together when the helmet and bellows are assembled on the wearer. Either of the attaching rings can have a rotatable seal therein so that one ring will turn about the other. Such a locking means may be in the form of spaced projections which extend outwardly from the ring attached to the neck opening and inwardly from the ring attached to the bellows so that, when the attaching ring of the bellows is positioned over the attaching ring of the neck opening, the projections of one will mesh into

the spaces of the other. When the projections of the ring attached to the bellows are below those of the ring attached to the neck, a slight turn will bring them into locking engagement.

To assure pressure sealing of the two rings together, a gasket, such as an O ring, can be provided so that when the rings are in locking engagement, there is provided a pressure seal to maintain pressure within the suit. Advantageously, a locking detent may be provided to hold the projections in locked position.

In addition to the advantages of the present invention referred to above, other advantages are described below in connection with the specific embodiment shown in the drawings, it being understood that such embodiment is shown by way of illustration only, in which:

FIGURE 1 is a side view of the top portion of a pressure suit with the helmet thereof in a normal position;

FIGURE 2 is a side view of the top portion of a pressure suit with the front of the helmet in a raised position;

FIGURE 3 is a side view of the top portion of a pressure suit with the front of the helmet in a lowered position;

FIGURE 4 is a side view of the top portion of a pressure suit with the front of the helmet turned and in a lowered position;

FIGURE 5 is a side view of the top portion of a pressure suit with the front of the helmet turned and in a raised position;

FIGURE 6 is a view in elevation of the stabilized neck bellows with a portion thereof in section showing the rotatable neck seal;

FIGURE 7 is a sectional view taken along line 7—7 of of FIGURE 6 showing the details of the rotatable neck seal; and

FIGURE 8 is a sectional view taken on the line 8—8 of FIGURE 7 showing a means for locking component parts of the rotatable neck seal.

In the drawings, FIGURES 1 through 5 show a pressure flying suit 10 for use in high altitude flying capable of maintaining the wearer under full pressure when required. The flying suit has a body portion 11 adapted to cover the legs, body, shoulders, and arms of the wearer, with a neck opening 12 therein at the base of the neck. To marginal edge 13 of the neck opening 12 is secured a rotatable neck seal 14 capable of joining the neck and helmet portion of the flying suit to the body portion 11.

The rotatable neck seal 14 can have an inner ring 15 for clamping the marginal edge 13 of the neck opening to the neck seal. In addition to the inner ring, the marginal edge of the neck opening can be secured to the neck seal by cementing, or the like. Advantageously, the rotatable neck seal can be formed from an inner attaching means or locking ring 16, the inner periphery thereof attached to the neck opening, as heretofore described, with a deep annular groove 17 positioned in the top surface thereof. The outside bottom corner of the locking ring can be in the form of an annular notch 18 having in its upper surface a race 19. The inner corner of the inner locking ring 16 can have a beveled or curved surface 20 to eliminate any sharp edges pressing against the outer surface of suit 11 when the marginal edge of the neck opening is clamped to the rotatable neck seal (see FIGURE 7).

In order to form a rotatable seal capable of allowing the neck and helmet to rotate about the shoulders of the suit while still maintaining pressure in the suit, a resilient annular member 22 advantageously may be positioned in groove 17. The annular member can have a flat outer vertical surface 23 which rests against the outer vertical wall of groove 17 with the top surface 24 pitched upwardly and inwardly and the bottom surface 25 pitched

downwardly and inwardly. The top surface 24 can be shorter than the bottom surface 25 which rests against the bottom of the groove, and the inner surface of the ring can be constructed to define an inwardly directed annular V-shaped groove 26 which can extend to approximately the center of the member. For convenience of construction and ease of operation, the annular ring can terminate in rounded edges where the surface of the V-shaped groove meets the top and bottom surfaces 24 and 25, respectively.

Positioned on the annular ring 22 can be an annular L-shaped sealing element 27 having a downwardly depending inner flange 28 and an outwardly extending horizontal flange 29. The sealing element 27 is positioned so that the depending flange contacts the top edge of the V-shaped groove 26. In this position, the outer surface of flange 28 defines an annular opening 30 between the inner vertical surface of groove 17 and the rounded edge of the top of the flat surface 24. Flange 29 can have positioned thereon a raised annular land 31 having a flat surface 32 which extends above the surface of the top of inner locking ring 16.

Operatively connected to the locking ring is a ring-like member 33 having an upwardly extending portion 34 and an inwardly extending bottom portion 35. The bottom portion defines a lower race 36 adapted to receive a plurality of roller elements 37, such as metal balls, which ride against the surface of races 19 and 36 to allow the ring-like member to rotate about inner locking ring 16. Against inner surface 38 of the upwardly extending portion 34 is an inwardly extending flange 39 having its outer vertical edge in press-fit relationship with the inner surface 38 and so positioned as to make contact with the flat surface 32 of land 31 to hold the ring-like member 33 in rotatable contact with the roller element 37 (see FIGURE 7). In this position, rotation of the ring-like member about inner locking ring 16 causes the bottom surface of flange 39 to ride in contact with the surface of land 31, thereby providing a pressure seal when the resilient annular member 22 is expanded by pressure from within the suit.

The outer bottom portion of ring-like member 33 can be provided with an annular boss 40 having a slanting top surface 42. Centrally located on boss 40 is a plurality of equally spaced lateral extensions 43 defining spaces 44 substantially equal to the width of the extension. One of the extensions can be provided with a notch 45 (see FIGURE 8).

In order to connect the helmet and neck bellows to the rotatable neck seal in the neck opening of the suit 11 so as to encase the head and neck of the wearer, an outer attaching means or locking ring 47 can be provided. The outer locking ring can have an extended portion 48 terminating in an annular knob 49. A notch 50 is adapted to retain annular O ring 51, which is capable of contacting slanting surface 42 when the outer locking ring is positioned over the inner ring-like member to effect a seal between the outer locking ring and the ring-like member 33. The lower inner portion of the outer locking ring is provided with equally spaced lateral extensions 52 adapted to fit in spaces 44 and, when O ring 51 is in sealing engagement with slanting surface 42, adapted to be in a position so that turning of the outer locking ring positions the extensions in locking engagement with each other.

The outer bottom portion of the locking ring 47 has an annular boss 53 with a detent means therein. The detent means has a knob 54 attached to an extended shaft 55 which passes through a hole in boss 53. The end of shaft 55 has a second knob 56 adapted to move back and forth in an enlarged hole in boss 53 and biased inwardly, such as by a spring 57. When the lateral extensions are in locking contact with each other and the detent means in line with notch 45, the biasing means forces the second knob 56 into notch 45, thereby securing the locking ring and the ring-like member together.

Attached to the outer locking ring is the marginal edge of a neck-enclosing bellows 59 which can be cylindrical in form and held in clamped position by a clamping ring 60. The edge of the bellows, in addition, can be cemented or the like to assure a tight seal to the outer locking ring. Advantageously, the bellows can be formed from flexible material, such as several plies of rubber and cloth united together. The surface of the bellows can have a helical indentation 61 to facilitate a bending action through an axis substantially vertical to the convolutions of the helix.

Advantageously, the bellows can have stabilization elements 62 which can be in the form of substantially nonstretchable wires embedded in the sides of the bellows opposite to each other to permit freedom of bending upward or downward between the stabilization elements. The top marginal edge 63 of the bellows is attached to a helmet 64 which is provided with a visor 65 capable of being closed to a sealed position when the suit is pressurized. The attachment can be by a ring clamp 66, as heretofore described, and can in addition be sealed to the helmet by cementing or the like. The stabilization wire, to stabilize the bellows more effectively, can have extended ends both at the top 67 and the bottom 68, with the bottom ends attached to outer locking ring 47, such as by a block 69. The block can be held to locking ring 47 by screws 70. In the block is provided a hole 71 through which the bottom end 68 of the stabilization wire extends. The wire is curved through a 90° curve and secured to the block by a threaded end piece 72 adapted to receive a nut 73 which abuts the edge of the block. The top ends 67 of the wires are affixed to the helmet 64 by a pivotal lug 74 which pivots on pin 75 in a bracket 76 which can be attached to the helmet, such as by riveting or the like.

In operation, the suit 11 is assembled on the wearer. The helmet 64 with its connected bellows 59 is fitted over the head. In this position, the outer locking ring 47 fits over the ring-like member 33 with the extensions of one meshed with the extensions of the other. When the extensions of the outer locking ring are passed downward through the spaces of the ring-like member and turned a distance equal to the width of a projection, the outer attaching ring is in locked position with the O ring providing a seal between the outer locking ring and the ring-like member. In this position, the detent lock engages the notch 45 and assures a fixed position.

When the visor closure 65 is placed in sealed engagement with the front of the helmet, the flying suit is ready to be pressurized. As pressure is introduced into the flying suit 10, the V-shaped annular groove 26 is expanded so that the flat top surface of the resilient annular member contacts the underside of the L-shaped sealing element 27 forcing the flat surface 32 of land 31 in contact with the underside of the inwardly extending flange 39 to form a rotatable seal. The helmet and neck bellows are then free to turn with the underside of flange 39 riding on the flat surface of land 31 with the pressure in the suit maintained during rotation. The rotatable seal arrangement and stabilization means on each side of the neck bellows are free to rotate with the rotatable neck seal so as to provide a complete range of normal head motion.

Although the present invention has been described with particularity with reference to a preferred embodiment, it will be obvious to those skilled in the art, after understanding the invention, that various changes and modifications may be made therein without departing from the spirit and scope of the invention, and the appended claims should therefore be interpreted to cover such changes and modifications.

What is claimed is:

1. A pressure suit for high altitude flying which com-

prises a suit adapted to cover the body of the wearer defining a neck opening therein; a helmet for encasing the head and movable therewith defining an opening in the bottom thereof; an extended neck-enclosing bellows, the upper edge of said bellows sealed in said helmet opening; a rotatable attaching means connectively securing the lower edge of said bellows to said neck opening, said attaching means permitting rotation of the helmet and the bellows as a unit about the base of the neck; a rotatable pressure seal positioned in said rotatable attaching means for maintaining pressure within the suit during movement of the helmet; said rotatable attaching means and bellows permitting simultaneous unrestricted vertical tipping and rotary movement of the helmet; and stabilization means positioned in the side of said bellows.

2. A pressure suit for maintaining the body of a wearer under full pressure during high-altitude flying which comprises a suit covering the body portion of the wearer, said suit defining an opening at the base of the neck; an inner attaching ring sealed in said neck opening; a helmet for encasing the head defining an opening in the bottom portion thereof; an extended neck-enclosing bellows having its upper edge sealed in said helmet opening; an outer

attaching ring sealed to the lower edge of the neck bellows, said outer attaching ring adapted to fit over and to lockingly engage said inner attaching ring to form a rotatable neck joint; roller means positioned in said neck joint; a pressure seal in said neck joint to permit said bellows and helmet to rotate as a unit about the base of the neck while maintaining pressure within the suit; said rotatable neck joint and bellows permitting simultaneous unrestricted vertical tipping and rotary movement of the helmet; and vertical stabilization means attached to each side of said bellows, one end of each stabilizing means secured to said helmet and the other end secured to said outer attaching ring.

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