

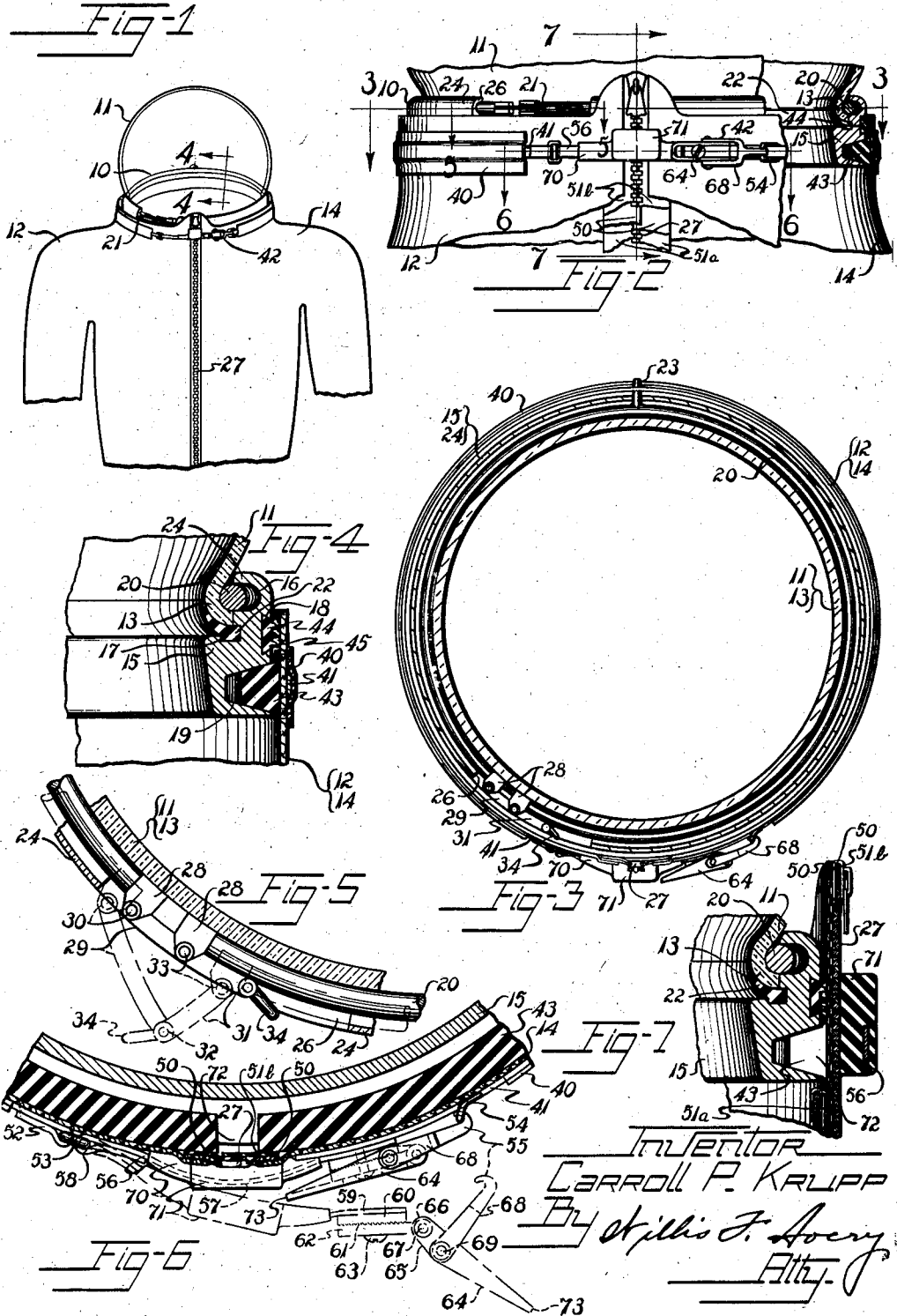
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JOINT STRUCTURE

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JOINT STRUCTURE

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This invention relates to joints or connectors, and especially to connector rings for joining structures containing fluid, such as air, under pressure.

In the construction of an inflatable suit for persons who fly at high and low altitudes, it is desirable to provide for the use of the suit with and without a headpiece or helmet attached to the body portion. It is desirable that flight operations be conducted at low altitudes without having the headpiece secured to the suit, but in the region of the stratosphere, the headpiece is a necessary part of the inflatable suit for effectively protecting the wearer against harmful physiological effects of the rarefied air, such as "bends" and oxygen deficiency. From the standpoint of safety of the wearer, it is advisable that the joint between the headpiece and the suit be quickly and conveniently engaged and disengaged, and be adapted for maintaining a fluid-tight seal during the engagement of these parts.

Accordingly, objects of the invention are to provide effectively for detachably connecting a pair of hollow structures, for example, the headpiece and body of the suit; to provide effectively for preventing leakage of fluid; to provide for convenience of attachment and detachment; and to provide for simplicity of construction, ease of manufacture, and convenience and reliability of operation.

Specific objects of my invention are to provide ring means for connecting a headpiece to a body portion of an inflatable suit, and to provide for preventing leakage of fluid at the joint between the headpiece and the flexible wall of the suit while providing for detachably joining the headpiece and the suit in a convenient manner.

These and other objects and advantages of the invention will be apparent from the following description.

In the accompanying drawing, which forms a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Fig. 1 is a front view of a united inflatable suit and headpiece constructed in accordance with and embodying the invention.

Fig. 2 is a front view of the joint between the headpiece and the body, parts being broken away and in section.

Fig. 3 is a view taken along line 3-3 of Fig. 2.

Fig. 4 is a view in an enlarged scale taken along line 4-4 of Fig. 1.

Fig. 5 is a view in an enlarged scale taken along the line 5-5 of Fig. 2.

Fig. 6 is a view in an enlarged scale taken along the line 6-6 of Fig. 2, and

Fig. 7 is a view in an enlarged scale taken along the line 7-7 of Fig. 2.

The illustrated embodiment of the invention, as shown in Figs. 1 and 2, a ring structure 10 interconnects a headpiece 11 or helmet with a body portion 14 of an inflatable suit 12 having walls of flexible material, and provides especially for the quick and convenient attachment and detachment of the headpiece. The ring structure 10 is, preferably, though not necessarily, circular in form, and may be oval, square, rectangular, or other suitable shape or form. The headpiece 11 may be made of any suitable rigid material, such as a transparent plastic or glass, and may have any suitable form to accommodate the head. It is desirable that the opening for admitting the head of the wearer be defined by an outwardly curved flange portion 13. The walls of the body portion 14 of the suit 12 may be made of any suitable material, preferably of fabric impregnated or coated with a rubber-like or other suitable substance.

In Figs. 2 and 4 a ring element 15, which may be of aluminum alloy for light weight, has a pair of circumferential grooves 16 and 17 in the inner face and a pair of circumferential grooves 18 and 19 in the outer face to receive fastening means and sealing means for the helmet 11 and the suit 12. An expansible contractible member 20 having a toggle locking structure 21 or other suitable fastening means is disposed in the groove 16 and is adapted to engage the flange 13 of the helmet 11, when in the contracted and locked position. This member 20 may be made of spring steel rod bent to circular form and suitably protected against corrosion, as by cadmium electroplating. The arrangement is such that member 20 tends to spring outwardly to an enlarged diameter and may be held to its smaller diameter by the locking structure 21. A lip sealing means 22 of resilient rubber-like material is seated in the circumferential groove 17 whereby peripheral contact is provided with the inner surface of the headpiece flange 13, effectively preventing leakage of fluid from within the headpiece.

The member 20 has a stud projection 23 extending radially outward through an opening in a wall portion 24 of the ring element 15, the projection 23 being disposed approximately diametrically opposite the toggle locking structure 21, as shown in Figs. 1 and 3. This projection 23 functions as a locating means for registering the

member 20 with respect to the peripheral opening 26 in the wall portion 24 in which opening is disposed the locking structure 21, and as a means for registering the suit 12 and the ring structure 10 for the proper positioning of a slide fastener 27, and as a means for preventing rotatable movement of the member 20 in the groove 16 during manipulation of the toggle 21.

U-shaped ear elements 28 having transverse openings for pins 30 and 33 in the ends of the leg portions are secured to the ends of the member 20 in any desired manner, as by welding or brazing. Referring especially to Fig. 5, a lever 29 is connected pivotally to one of the ear elements 28 by the pin 30 and similarly connected adjacent the closed end of a forked member 31 by a pin 32. The open end portions of the two tines of the form 31 are connected pivotally to the other U-shaped element 28 by means of the pin 33. An extension 34 of the forked member 31 serves as a handle for manipulation of the toggle structure 21 to provide for expanding and contracting the member 20, as well as locking the latter to its smaller diameter.

The construction of Figs. 2, 3, 4 and 6 includes means for detachably securing the suit 12 to the ring element 15 in a fluid-tight manner. The wall of the body portion 14 may be provided with a suitable fabric sheath 40 adapted to encase a metal clamping ring or clamp-band 41; and the sheath 40 may be sewed, or adhered, or both, to the wall 14. The sheath encircles partially the body portion, as shown in Figs. 2, 3 and 6, in order to provide open space for convenient positioning and operation of a fastening and sealing structure 42. Preferably, the band 41 and the sheath 40 are mounted adjacent the exterior side of the wall 14 at the region of the circumferential groove 19 of the ring 15.

The groove 19 is preferably trapezoidal in section. A ring member 43, likewise trapezoidal in section, is made desirably of resilient rubber-like or other suitable material, preferably covered or otherwise suitably reinforced as by fabric, and is adapted to seat, at least partially, as shown in Fig. 4, in the groove 19 whereby the oppositely disposed and inwardly inclined faces of the member 43 are in contact with corresponding faces of the groove to provide for a sealing relation therewith. Furthermore, when the clamping ring 41 is in the locked position, as shown in Fig. 3, the wall 14 of the suit is pressed and held tightly against the adjacent face of the resilient member 43, and the latter member 43 is wedged firmly into the groove 19, thereby assisting in securing a peripheral fluid-tight seal between the wall 14 and the ring structure 15.

For convenience in assembling the suit 12 with the ring structure 10, it is desirable that the member 43 be attached to the wall portion 14 at the interior side by an adhesive or other suitable fastening means, in which case the ring member 43 is divided in the region of the margins of the slide fastener 27, as disclosed in Fig. 6. With such an arrangement a fluid seal may be provided at the slide fastener portion of the wall 14 in a manner hereinafter discussed.

A sealing element 44 having, preferably, a plurality of lip portions 45 is disposed in the groove 18 in the outer face of the ring element 15 and may be secured in the undercut groove 18 by wedging or other suitable manner. This sealing element 44 is made of resilient rubber-like or other suitable material; and the lip portions 45, being adapted to be circumferentially in contact

with the wall 14, prevent leakage of fluid from within the suit 12.

The wall portion 14 of the suit 12 may be tailored in a manner to provide for pressing and wedging the divided ring member 43 in the groove 19 and to provide desirable sealing contact with the sealing element 44 when the slide fastener 27 is in the closed position; but it is preferable to utilize the clamping ring 41 and its associated fastening and sealing means 42 for accomplishing these results. Another modification may be made in the clamping ring 41 wherein the ring is made wide enough to apply positive pressure coincidentally upon the annular element 43 and the sealing element 44.

As shown especially in Figs. 2, 3, 6 and 7 the slide fastener 27 is desirably of a dual construction having a pair of sealing flaps 50 disposed between inner and outer closure flaps 51a and 51b, the flaps 50 and 51b extending upwardly beyond the upper face of the ring structure 10. However, the inner closure flaps 51a extend only to the lower face of the ring element 15 in order to avoid bulkiness and to permit securing a tight seal of the flaps 50 at the ring member 43 and the sealing element 44.

In the arrangement shown in the drawing, the ends of the clamping ring 41 are interconnected by the fastening and sealing structure 42, one end 52 being movably secured to the structure by a link 53 in the manner shown in Fig. 6, while the other end terminates in a link 54 adapted for engagement with a hook portion 55 of the structure 42.

In the construction of the fastening and sealing structure 42 a metal strip 56, or other suitable element, which may have an outwardly bulged portion 57 intermediate the ends thereof, has one end 58 bent over in engagement with the link 53 to provide for swinging movement, while the other end 59 is equipped with a fitting 60 having transverse serrations 61 in the outer face and a threaded opening therein. An element 62 having similar serrations in a face thereof and a slotted opening therein is attached adjustably to the fitting 60 by a screw 63 engaging through the slotted opening with the threaded opening, the respective serrated faces being in contact with each other.

A member 64, which is U-shaped in section and which has one end forked at 65, is pivotally attached at the forked end to a bulbous end portion 66 of the element 62 by means of a pin 67 extending through transverse openings in the said ends of the member 64 and the element 62. The member 64 is adapted to be in overlapping relationship with the element 62. A forked member 68 having the hook end portion 55 is pivotally secured to the member 64 intermediate the ends of the latter by means of pins 69 extending through openings in the respective members, as shown in Figs. 2 and 6. When the members 64 and 68 are in the closed position, the hook 55 engages with the link 54 thus clamping the band 41 firmly against the wall 14 and the ring member 43. Grasping the end 73 of the member 64 nearest the slide fastener 27 and pulling outwardly releases the clamping ring 41 and fastening means 42.

For facilitating the provision of an effective fluid-tight seal at the slide fastener 27 junction with the ring structure 10, the bulged portion 57 of the metal strip 56 may have a suitably shaped body 70 of resilient rubber-like material disposed adjacent the inner surface thereof and

vulcanized and bonded to the same. The body 70 has a central portion 71 projecting upwardly in the direction of the sealing element 44 to an extent sufficient to permit the portion 71 to overlie the element 44. In this manner the sealing flaps 50 of the slide fastener 27 and the margins of the wall 14 are pressed positively against the lip seals 45 of the element 44, and also the margins of the wall 14 are pressed positively against the member 43, by virtue of which effective sealing is obtained. However, the metal strip 56 may be shaped to function in like manner. Additionally, the pressure within the suit presses the overlapping portions of the sealing flaps 50 together against the backing support of the outer closure flaps 51b and the body 70, which provides an effective fluid seal at the space 72 between the ends of the ring member 43.

The use and operation of the ring structure 10 in combination with the suit 12 and the headpiece 11 has the advantages of reliability, simplicity, and convenience plus safety to the wearer of the suit. The ring structure may be attached to the body portion 14 after the wearer has donned the suit 12, and this is easily accomplished, especially when the ring member 43 is carried by the wall portion 14 in the manner hereinabove described. With the slide fastener 27 and the clamping ring fastener 42 in the open position, the stud projection 23 of the ring 10 is inserted through an opening in the back portion of the suit after which the ring member 43 is disposed in the groove 19. Then the inner closure flaps 51a of the slide fastener 27 are closed adjacent the lower face of the ring 10, and after positioning the sealing flaps 50 such as to promote their overlying relationship throughout their extent, the outer closure flaps 51b are closed, including that portion extending adjacent and beyond the ring structure 10, as shown in Figs. 2 and 7. The final step in this phase of operation is to place the fastening and sealing means 42 in contact with the wall portion 14 and to engage the hook 55 with the link 54 while manipulating the toggle members 64 and 68 in a manner like that shown in Fig. 6. The extent of pressure exerted by the clamping ring 41, including the fastening and sealing means 42, should be sufficient to press firmly the ring member 43 in contact with the sides of the groove 19 and to press firmly the wall portion 14 and slide fastener 27 in contact with the member 43, as well as against the lip seal portions 45; thus a fluid-tight joint is assured. Longitudinally adjusting the fitting 60 and the element 62 with respect to each other permits securing the desired clamping pressure.

In order to complete the protection of the wearer of the suit, the headpiece 11 is slipped over the head of the wearer and the curved flange portion 13 is seated in place against the lip-sealing ring 22 and is in contact with the inner face of the ring element 15, while the expansible-contractible member 20 is in the released position. Next the toggle locking structure 21 is placed in the closed position, as indicated in Fig. 5, whereupon the member 20 moving inwardly in the groove 16 engages the flange portion 13 of the headpiece 11. In this way the headpiece is united detachably with the ring structure 15 in a fluid-tight manner. The ensemble of the suit 12, the ring structure 10, and the headpiece 11 affords complete coverage and effective protection of the wearer during flight in the region of the stratosphere, when associated with means for supplying

oxygen and air under pressure; and the head-piece may be removed conveniently in lower altitudes.

Variations may be made without departing from the scope of the invention as it is defined in the following claims.

I claim:

1. In an inflatable suit having a body portion and a headpiece, means for connecting said headpiece to said body portion, said means comprising a ring structure having an inner face and an outer face, means for detachably engaging said headpiece in a fluid-tight manner with said ring structure at one of said faces, and means for detachably engaging said body portion in a fluid-tight manner at the other of said faces.
2. In an inflatable suit having a body portion and a headpiece, a ring structure for joining said headpiece to said body portion, said means comprising a ring structure having an inner face and an outer face, means for detachably engaging said headpiece in a fluid-tight manner with said ring structure at said inner face, and means for detachably engaging said body portion in a fluid-tight manner at said outer face.
3. A coupling for interconnecting a pair of hollow structures, said coupling comprising an annular structure having an inner and an outer face and having a circumferentially extending depression in said inner face, means disposed in said depression for detachably engaging one of said hollow structures with said annular structure, and means for detachably securing the other said hollow structure to said outer face.
4. A coupling for interconnecting a pair of hollow structures, said coupling comprising an annular structure having an inner and an outer face and having a circumferentially extending depression in said outer face, means for detachably securing one of said hollow structures to said inner face, and means including an element projecting from the other said hollow structure adapted to register with and be disposed in said depression and adapted for detachably securing the other said hollow structure to said outer face.
5. A coupling for interconnecting a pair of hollow structures, said coupling comprising an annular structure having an inner face and an outer face and having circumferentially extending depressions in said faces, and means for detachably securing said hollow structures to said annular structure, said means including elements registering with said depressions for locking said hollow structures to said annular structure.
6. A connector for interconnecting a pair of hollow structures, said connector comprising a ring structure having a pair of spaced-apart circumferential grooves therein, and means for detachably securing said hollow structures to said ring structure, said means including circumferentially extending locking elements registering with said grooves.
7. A connector for interconnecting a pair of hollow structures adapted to contain a fluid, said connector comprising a ring structure having an inner and an outer face and having circumferential grooves in said faces, means disposed in a groove in said inner face for detachably engaging one of said hollow structures with said ring, means registering with and disposed in a groove in the outer face of the ring and detachably securing the other hollow structure to said ring structure, and sealing means including resilient elements interposed between said ring and the hollow structures.

8. In an inflatable suit having a body portion and a headpiece, a ring structure for joining said headpiece to said body portion, said ring structure comprising a ring element having an inner face and a circumferential depression in said face, an expansible-contractible member disposed in said depression and adapted to engage said headpiece for detachably securing said headpiece to said ring structure, means for changing said member between expanded and contracted conditions, lip-sealing means between said ring element and said headpiece, and means for attaching said body portion to said ring element.

9. In an inflatable suit having a body portion including a wall of flexible material and having a headpiece, a ring structure for joining said headpiece to said body portion, said ring structure comprising a ring element above which said headpiece is adapted to extend and having a circumferential groove therein, and means for detachably securing and sealing the wall of said body portion to said ring, said means comprising an annular element of resilient material positionable in said groove, and an expansible-contractible element for pressing the wall of said body portion and said annular element toward said groove.

10. In an inflatable suit having a headpiece and a body portion including a wall of flexible material, a ring structure for joining said headpiece to said body portion, said body portion having a slide fastener with sealing means in the region of the ring, said ring structure comprising a ring element above which said headpiece is adapted to extend and having an outer face with a pair of spaced-apart circumferential grooves therein, one of said grooves being generally trapezoidal in section, a sealing element disposed in the other said groove and adapted to contact the wall of said body portion, an annular element receivable in the trapezoidal groove, and a clamping ring adapted to bind the wall of said body portion against said annular element and said sealing element, said clamping ring having means for pressing said slide fastener against said sealing element.

11. In an inflatable suit having a headpiece and a body portion including a wall of flexible material, a ring structure for joining said headpiece to said body portion, said body portion having a slide fastener with sealing flaps in the region of the ring, said ring structure comprising a ring element having an inner face and an outer face and having a pair of spaced-apart ring grooves in each of said faces, an annular element disposed in one of said grooves in said inner face and

adapted to detachably engage said headpiece, a lip-sealing element seated in the other groove of said inner face and having a portion in contact with said headpiece, one of said grooves in said outer face being trapezoidal in section, a ring member of resilient material being disposed in said groove of trapezoidal section and being in contact with the side walls of the same, a sealing ring disposed in the other said groove in the outer face and having multiple lip portions extending outwardly from said outer face adapted to contact the wall of said body portion, and a clamping ring with fastening means adapted to detachably secure said body portion in contact with said ring member, said clamping ring having a projecting portion of resilient rubber-like material adjacent said slide fastener whereby a portion of the slide fastener including its sealing flaps is pressed against the lip portions of said sealing ring and against said ring member.

12. A coupling for a hollow structure, said coupling comprising a ring structure having a groove therein, and means for detachably locking said hollow structure with said ring structure, said means including a projecting locking element registering with said groove, and said locking element and groove being generally trapezoidal in cross-section for wedging engagement.

13. A coupling for a hollow structure, said coupling comprising a ring structure having a groove extending circumferentially therein, and means for detachably locking said hollow structure with said ring structure, said means including a locking element extending circumferentially and registering with said groove, said locking element including resilient rubber-like material and said groove being generally trapezoidal in cross-section for wedging engagement.

14. In an inflatable suit having a body portion including a wall of flexible material and having a headpiece, a ring structure for joining said headpiece to said body portion, said ring structure comprising a ring element for supporting said headpiece and having a circumferential groove generally trapezoidal in cross-section therein, and means for detachably securing and sealing the wall of said body portion to said ring element, said means comprising an annular element of resilient material and generally trapezoidal in cross-section positionable in said groove and an expansible-contractible element for pressing the wall of said body portion and said annular element toward said groove.

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