

Dec. 11, 1962

R. S. COLLEY

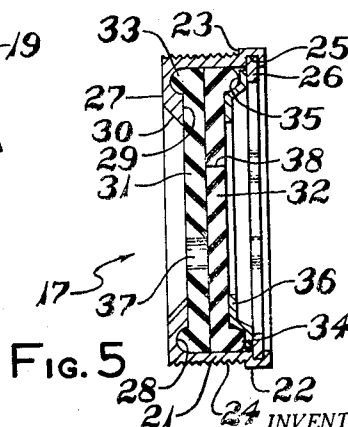
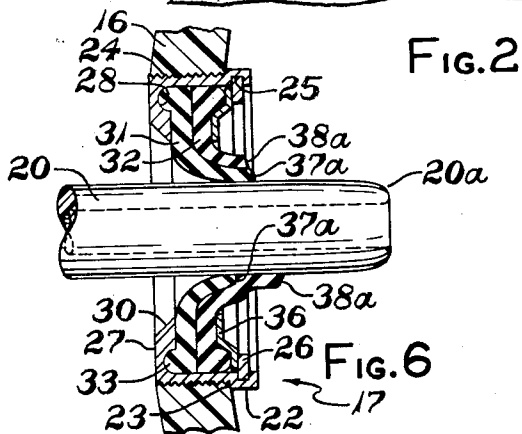
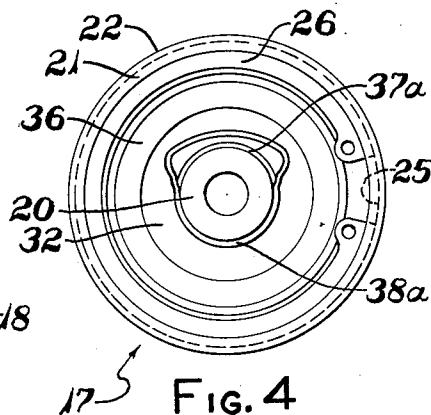
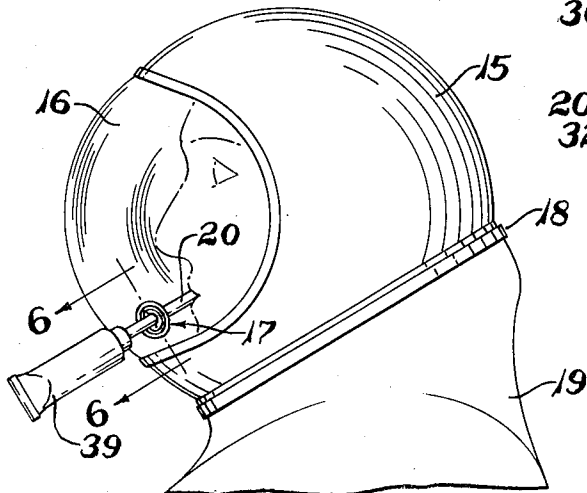
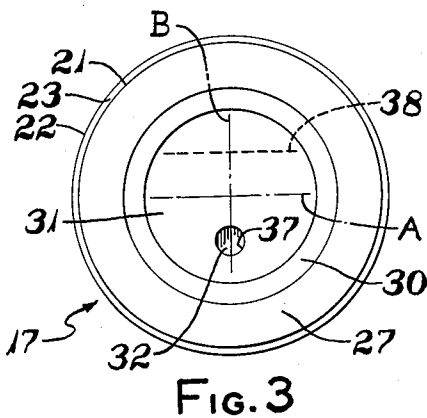
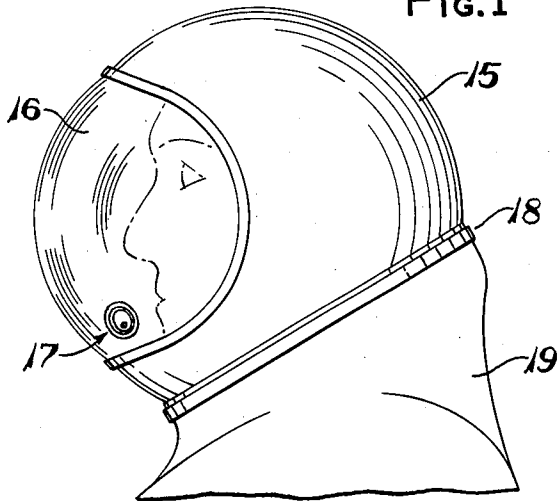
3,067,425

FLYING SUIT HELMET WITH PENETRABLE SEALING CLOSURE STRUCTURE

Filed Nov. 9, 1959

2 Sheets-Sheet 1

Fig. 1



INVENTOR.
RUSSELL S. COLLEY
BY *Dwight L. Moody*

ATTY.

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2 Sheets-Sheet 2

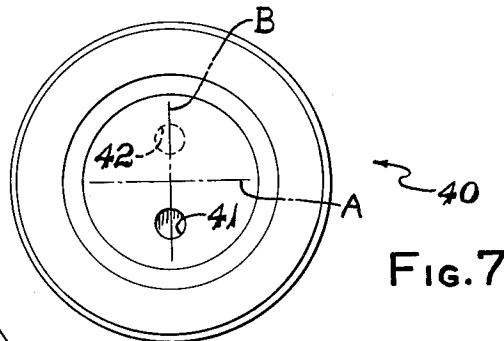


FIG. 7

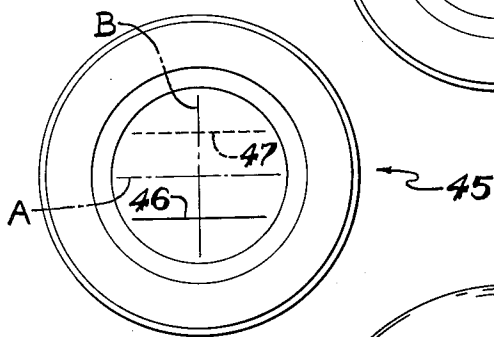


FIG. 8

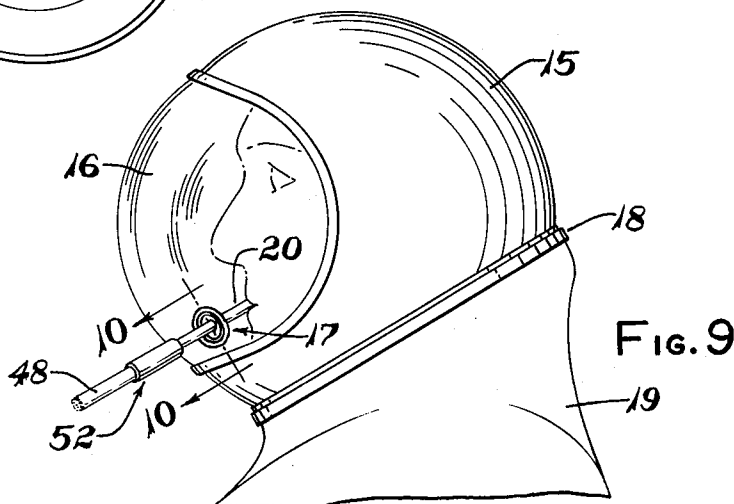


FIG. 9

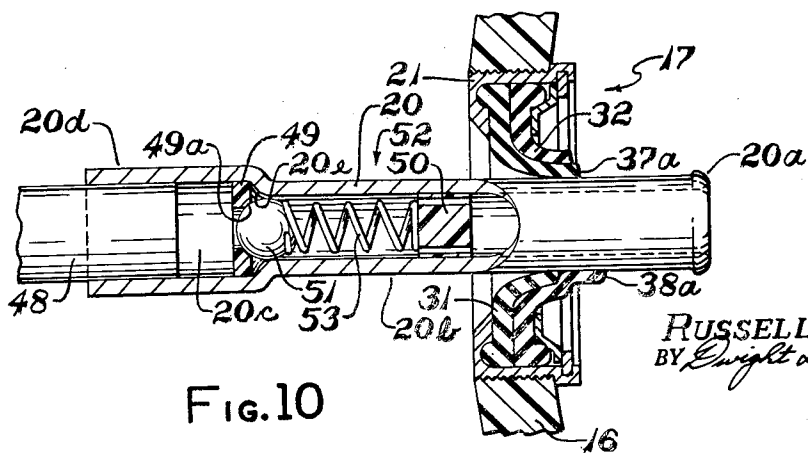


FIG. 10

INVENTOR.
RUSSELL S. COLLEY
BY *Eugene L. Moody*

ATTY.

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FLYING SUIT HELMET WITH PENETRABLE SEALING CLOSURE STRUCTURE

Russell S. Colley, Cuyahoga Falls, Ohio, assignor to The B. F. Goodrich Company, New York, N.Y., a corporation of New York

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13 Claims. (Cl. 2-6)

This invention relates to a flying suit helmet including penetrable sealing closure means permitting the temporary insertion of a tube into the pressurized interior space of the helmet, especially a tube for enabling the wearer to receive food and liquid, or to smoke under high altitude flight conditions.

Heretofore, flying suit helmets provided with an internal fluid i.e. gaseous pressure exceeding that of the ambient atmosphere during high altitude flight, have not permitted the wearer or aviator to receive food and water, or to smoke a cigarette or a cigar, for example, while the said fluid pressure is maintained. When such helmets had a transparent visor or eye-piece permanently secured to the remainder of the helmet, it was necessary to remove the entire helmet from the wearer's head whenever the wearer desired to seat and drink or to smoke. When the visor or eye-piece was pivotally mounted on the helmet, the visor or eye-piece was swung upwardly from in front of the wearer's face before the wearer could eat and drink or smoke. However, in both cases it was necessary for the wearer to be at a safe, relatively low altitude such, for example, as about 10,000 feet, where an internal fluid pressure was not required to be maintained within the helmet.

Accordingly, it is the principal object of the invention to provide a flying suit helmet in which an internal fluid pressure can be maintained, while at the same time permitting the wearer to receive food and water and/or to smoke a cigarette or a cigar.

Other objects of the invention are to provide for the temporary insertion of a tube through an access opening in a wall portion of an internally pressurized helmet by operation wholly external of the helmet without loss of its internal pressure; to provide for such insertion and subsequent withdrawal of the tube at a location convenient to the wearer's mouth; to provide a penetrable sealing closure means for an access opening in a flying suit helmet capable of sealing the opening and withstanding the internal fluid pressure and capable of sealing against a tube insertable through the said closing means; to provide for convenient replacement of a penetrable sealing wall member of the closing means; to provide for resilient deformation and conformance of the sealing portions of said wall member to the inserted tube together with the resilient return of the sealing portions to their non-deformed condition upon withdrawal of the tube; to provide for means adapted to conduct water and/or liquid food through the closure means to the wearer; to provide means for holding a cigarette or a cigar and for conducting smoke through the closure means to the wearer; and to provide for simplicity of construction, convenience of manufacture, installation and servicing and for effectiveness of operation.

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

In the accompanying drawings which constitute a part of this specification and in which like numerals are employed throughout to designate like parts:

FIG. 1 is a side elevational view of a helmet including a penetrable sealing closure means or structure removably attached to an inflatable flying suit, and constructed in accordance with and embodying the invention, parts being broken away;

FIG. 2 is a view like FIG. 1 but showing a fluid-con-

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ducting tube of a food container extending through the closure structure, parts being broken away;

FIG. 3 is a plan view on an enlarged scale of the penetrable sealing closure structure as viewed from the external side of the same before mounting in the helmet and with sealing members of the said structure in an undeformed condition;

FIG. 4 is a plan view like FIG. 3 but showing the unmounted closure structure as viewed from the internal side of the same with the sealing members in sealing contact with and resiliently deformed in conformance with the fluid-conducting tube;

FIG. 5 is a cross-sectional view taken along the vertical center line of FIG. 3 showing the unmounted closure structure with the sealing members in their normal undeformed condition;

FIG. 6 is a cross-sectional view on an enlarged scale and taken along line 6-6 in FIG. 2 showing the said fluid-conducting tube extending through openings in the resiliently deformed sealing members, parts being broken away;

FIG. 7 is a view like FIG. 3 but showing a modification having a pair of vertically spaced circular openings in the sealing members of the closure structure;

FIG. 8 is a view like FIG. 3 but showing another modification having a pair of vertically spaced openings of horizontal slit configuration in the sealing members of the closure structure;

FIG. 9 is a view like FIG. 2 but showing a tubular cigarette holder extending through the closure structure in the helmet, parts being broken away; and

FIG. 10 is a cross-sectional view on an enlarged scale taken along line 10-10 in FIG. 9 showing the tubular cigarette holder and the resilient deformation and sealing contact of the sealing members with the tube of the said holder, parts being broken away.

The embodiment of the invention shown in FIGS. 1 to 6, inclusive, includes a helmet 15 of generally domed configuration, that is approximately hemispherical configuration, with a visor or eye-piece portion 16 of rigid transparent material and a penetrable sealing closure means 17 mounted in an access aperture preferably through the lower region of the visor portion so as to be positioned in front of the wearer's face adjacent the mouth of the wearer as shown especially in FIGS. 1 and 2. The particular helmet shown in the drawings entirely encloses the wearer's head and has preferably a rigid reinforced plastic wall of known construction and the rigid transparent visor portion 16 may be fixedly secured as shown in known manner, or if desired, pivotally mounted in known manner, in fluid-tight sealing relation to the adjacent non-transparent plastic wall of the helmet to protect the wearer's face.

The helmet 15 is detachably secured by suitable connector ring means 18 in fluid-tight sealing relation to the impervious flexible wall of an inflatable flying suit 19. With the flying suit inflated as shown in FIGS. 1 and 2, the internal fluid i.e. gaseous pressure within the helmet 15 exceeds that of the ambient atmosphere and may be in the order of approximately 3.5 to 5.0 pounds gage. The penetrable sealing closure means 17 of the invention prevents effectively loss of internal pressure within the helmet 15 even when a rigid tube 20 including its open end portion 20a extends through the closure means to the mouth of the wearer as shown especially in FIG. 2.

The preferred construction of the penetrable sealing closure means 17 or structure comprises a rigid tubular housing 21 of aluminum alloy, or magnesium alloy, or stainless steel, or brass, or other metal suitable for the intended purpose. Desirably the housing 21 is made of aluminum alloy which is anodized by a known process to

provide a protective coating for resisting corrosion of the housing. The housing 21 may be of uniform outside diameter along its major axial extent but desirably terminates at one end (its inner end) in a radially outward-extending flange portion 22. This provides an annular external shoulder 23 adapted to seat against the inner surface of the visor portion 16 at the margin of the access opening therein as shown especially in FIG. 6, whereby the tubular housing cannot be forced through the access opening under the influence of the internal fluid pressure within the helmet. The cylindrical outer surface of the housing 21 may be smooth but is desirably circumferentially grooved as indicated at 24 to receive an adhesive in the shallow grooves and thus facilitate adhesively securing the housing to the material of the visor portion 16. Such adhesive attachment together with the annular shoulder 23 absolutely prevent accidental dislodgement of the housing 21 from its position within the access opening of the visor portion, and also provides a positive seal against fluid leakage and loss of internal pressure.

The outward flange portion 22 of the housing has in its radially inner surface a continuous annular recess 25 adapted to receive therein a radially divided retaining ring 26 of the spring type as shown especially in FIGS. 4, 5 and 6, the functioning of which retaining ring 26 will be described more fully hereinafter.

The tubular housing 21 has preferably at its opposite end (i.e. outer end) a continuous annular internal flange portion 27 of substantially uniform radial width having an annular bead-receiving recess 28 therein at the radially outer region of the axially inner surface 29 of the flange, the bead-receiving recess being of substantially semi-circular configuration in cross section, while the radially inner remainder of the axially inner surface 29 is substantially planar. This planar annular portion of the inner surface 29 has sufficient width radially to constitute a supporting surface of the flange 27. The radially inner margin 30 of the flange may be flared axially outward as shown to constitute a guide for guiding the entrance of the tube 20 into the closure means 17.

The closure structure 17 includes a transverse substantially planar sealing wall member which may consist of a pair of individual sealing members 31, 32, of highly stretchable, deformable, elastomeric i.e. resilient rubbery material and substantially planar circular i.e. flat disk configuration in superimposed face-to-face contact within the bore of the tubular housing 21. The elastomeric or rubbery material of the sealing members is preferably a suitable highly resilient, stretchable, deformable natural rubber composition, although not necessarily limited thereto, since synthetic rubber compositions may be utilized providing they have the required high stretchability, resiliency, and deformability characteristics.

Each of the sealing members (31, 32) may be molded and has a smooth planar surface at one side of the member throughout its entire area, whereby these planar surfaces are in face-to-face relationship and continuous contact with one another, when the sealing members are mounted within the housing and in normal position as shown especially in FIG. 5. Each sealing member (31, 32) has a smooth planar surface at its other side except at the periphery or circumference thereof, where an integral bead portion (33, 34) projects axially and extends continuously about the circumference of the member and desirably has a semi-circular configuration in cross-section. In the preferred construction, the respective sealing members 31, 32 are of the same uniform thickness throughout their area radially inward of the bead portions 33, 34, which thickness is substantially less than the diameter of the sealing member yet provides sufficient strength to prevent bursting, when the sealing member is subjected to the internal gaseous pressure in the helmet 15. For example, when the outside diameter of the sealing member is approximately 0.742 inch, the said uniform thickness of said area is 0.050 inch with the maxi-

mum overall thickness at the bead portion being 0.081 inch, whereby the sealing member snugly fits within an 0.752 inch diameter bore in the tubular housing 21 which has an outside diameter of 0.812 inch.

When the sealing members 31, 32 are disposed transversely of the bore in their normal position with their adjacent planar surfaces contacting one another, the bead portion 33 of the sealing member 31 projects axially in one direction and is seated in and contacts the wall of the annular recess 28 in the end flange portion 27. The bead portion 34 of the other sealing member 32 projects in the opposite axial direction in axial alignment with the bead portion 33 and is accommodated within an annular bead-receiving recess 35 provided by a continuous annular retaining washer 36 of stainless steel or other suitable metal. The retaining washer 36 at its radially outer region is offset axially toward the adjacent inner end of the housing in the manner shown in FIG. 5 to provide the bead-receiving recess 35. The remainder of the retaining washer radially inward of the integral offset portion thereof is of planar configuration and radially coextensive with the annular planar inner surface 29 of the flange portion 27, that is, it is in overlying, overlapping, substantially parallel relation to the surface 29, and seats against the adjacent planar surface of the sealing member 32.

When the continuous annular retaining washer 36 is removably secured within the housing 21 by means of the spring retaining ring 26 of steel seated in the annular recess 25 and in contact with the said offset portion of the retaining washer as shown in FIG. 5, the annular bead portions 33, 34 of the sealing members are maintained seated in the respective annular bead-receiving recesses 28, 35 to thereby securely hold the sealing members 31, 32 against being blown out of the tubular housing 21 under the influence of the internal fluid or gaseous pressure and in addition function as an effective resilient O-ring seal against leakage of the pressurized gas through the closure structure 17. A further advantage of the bead portions 33, 34 is that they prevent effectively pulling the sealing members from within the housing 21, when the sealing members are being highly stretched and resiliently deformed during the insertion and withdrawal of the tube 20.

The pair of sealing members 31, 32 may, if desired, be adhesively united one to the other as by a suitable rubber cement at the radially outer region of their contacting adjacent planar surfaces throughout the radial width of the bead portions 33, 34 without objectionably hindering the high stretchability and the resilient deformability of the sealing members 31, 32, especially at their central areas bounded by the radially inner annular margin of the internal end flange portion 27 and of the retaining washer 36. When the sealing members 31, 32 are adhesively united in this manner they, in effect, constitute a single, unitary, substantially planar sealing wall member divided intermediate its thickness throughout at least the central area thereof spaced from the periphery thereof, thereby providing throughout said central area a pair of superimposed substantially planar sealing portions in face-to-face contact. These sealing portions are adapted to stretch and deform independently of one another, while at the same time co-acting with one another to maintain the seal with or without the tube 20 through the closure structure 17.

The sealing members 31, 32 include openings 37, 38 extending through the respective exposed central or planar sealing portions of the members as shown in FIG. 5. The opening 37 in the particular construction shown in FIGS. 1-6, inclusive, is circular and is spaced from one side of a diametral center line, indicated by the letter "A," of the sealing member 31. The opening 37 is closed and sealed by the adjacent abutting continuous wall part of the sealing member 32 when the sealing members 31, 32 are in their normal undeformed condition as shown in

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FIGS. 3 and 5. The opening 38 in the other sealing member 32 is provided by a straight slit extending substantially parallel to the said diametral center line "A" at a position spaced therefrom and to the other side thereof. The opening 38 is closed and sealed by the adjacent abutting continuous wall part of the sealing member 31 when the sealing members are in their normal undeformed condition as shown in FIGS. 3 and 5.

The center of the circular opening 37 is located on the diametral center line, indicated by the letter "B," of the sealing member 31 normal i.e. perpendicular to the slitted opening 38 and to the first said diametral center line "A." It will be noted that the circular opening 37 is spaced radially inward from the circular margin 30 of the end flange portion 27, and the slitted opening 38 is also spaced radially inward from the margin 30 and terminates short of the margin 30. Thus, both openings 37, 38 are located within the exposed central area of the sealing members, hence the said planar sealing portions of the members are free to stretch and resiliently deform, whereby both openings 37, 38 can be transversely shifted into alignment with their marginal portions 37a, 38a flexed axially in sealing contact with the rigid tube 20, when the tube is inserted through the closure structure from the outside of the helmet as shown especially in FIG. 6.

The sealing member 31 with the relatively small diameter opening 37 through its substantially planar central sealing portion which is bounded by the radially inner margin 30 of the end flange portion 27, is resiliently stretched and deformed and flexed axially at said sealing portion in the direction toward the interior of the helmet 15 in the manner shown especially in FIG. 6 during the insertion of the tube 20. This produces the temporary engagement and the seating of that part 37a of the sealing portion of the member 31 immediately adjacent the opening 37 continuously about and in conforming contact with the tube 20 since the diameter of the tube 20 is substantially larger than the initial diameter of the opening 37.

The axial movement of the tube 20 during the insertion thereof also produces sufficient resilient stretching and deforming and axial flexure of the sealing member 32 to bring the straight slitted opening 38 into axial alignment with the opening 37 and at the same time compels the configuration of the slit to change to an approximately circular configuration. This permits the tube to penetrate and extend through the opening 38 in the sealing member as shown especially in FIG. 6.

It will be noted that the resiliently stretched, deformed and axially flexed annular marginal portions 37a and 38a defining the axially aligned openings 37 and 38, respectively, are in radially superimposed, contacting, sealing relation one to the other. Also, the entire annular marginal portion 37a is in sealing, contacting relation continuously about the tube 20, but only approximately one-half of the peripheral extent of the annular marginal portion 38a is in sealing contact with the tube 20, while the remainder of said peripheral extent of the annular marginal portion 38a contacts and conforms to the axially inward flexed annular marginal portion 37a as shown especially in FIGS. 4 and 6. The stretched, axially flexed marginal portion 38a radially backs and resiliently presses the stretched, axially flexed marginal portion 37a against the tube 20, while the fluid pressure within the helmet further increases the radially inward pressing force exerted by the marginal portion 38a against the marginal portion 37a. This assures continuity of the seal between the marginal portion 37a and the tube 20, and also the continuity of the seal between the marginal portion 38a and the said portion 37a and tube 20.

The tube 20 may have, for example, an outside diameter of $\frac{1}{4}$ inch when the sealing members have the dimensions given hereinabove, and when the circular central sealing portions of the sealing members bounded by the margin 30 of the end flange portion 27 and the radially

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inner margin of the retaining washer 36 have a diameter of .437 inch. Also, when the circular opening 37 has a $\frac{1}{16}$ inch diameter and is spaced $\frac{1}{16}$ of an inch from one side of a diametral center line "A" which is parallel to the slitted opening 38 as shown in FIG. 3, which slitted opening 38 has a length .281 inch and is spaced $\frac{1}{16}$ inch from the other side of said diametral center line "A." Thus, the tube 20 has a diameter which is four times that of the circular opening 37, but is slightly less than the length of the slit providing the opening 38; consequently, the resilient stretching and deformation and axial flexing of the sealing members 31, 32 are of considerable magnitude in order to accommodate the tube and to bring the transversely spaced openings 37 and 38 into axial alignment and at the same time effect the seal about the wall of the tube 20. The tube is preferably of rigid metal or plastic material and desirably has its free end 20a of generally rounded configuration in cross-section.

The helmet 15 attached to the inflatable flying suit 19 as shown in FIG. 1 entirely encloses the wearer's head and has an internal gaseous pressure of approximately 3.5 pounds gauge pressure under high altitude (for example, 25,000 to 50,000 feet) flight conditions. This internal pressure causes the sealing member 32 to press outwardly, uniformly and tightly against the sealing member 31 when the closure structure 17 is in its normal closed condition as shown in FIG. 1. Under the influence of this internal pressure, the sealing members 31, 32 at their central sealing portions with the spaced openings 37, 38 may be bowed slightly in the direction toward the exterior of the helmet so that they no longer have their normal planar configuration shown in FIG. 5. However, this bowing has no effect upon the seal since the opening 38 is closed by the adjacent continuous wall of the sealing member 31 and the opening 37 by the adjacent continuous wall of the sealing member 32, while the remainder of the adjacent contacting initially planar surfaces of the sealing members 31, 32 further assure maintenance of the seal. Thus, no leakage can occur through the openings 37, 38.

The annular bead portions 33, 34 securely hold the sealing members 31, 32 against being forced out of their position between the end flange portion 27 and the retaining washer 36, and also produce an effective O-ring seal against the tubular housing 21 including the end flange portion 27 thereof and against the retaining washer 36, all by virtue of their being held tightly between the end flange portion 27 and the retaining washer 36 and their being seated within bead-receiving recesses 28 and 35, respectively.

When the wearer wishes to eat or drink while the helmet is under the said internal gaseous pressure during flight at high altitude, the wearer holds a collapsible container 39 with liquid food or water therein in his hand, and then inserts the rigid tube 20 which is attached to the container 39, through the closure structure 17 until the free end portion 20a is in his mouth as shown in FIG. 2, after which insertion the container is manually collapsed to compel the contained liquid or liquid food to flow through the tube to the mouth. The insertion is accomplished by forcing the rounded end portion 20a of the tube 20 initially through the circular opening 37 in the sealing member 31. This simultaneously stretches and deforms and axially inwardly flexes both sealing members 31, 32 so as to bring the spaced-apart openings 37, 38 into axial alignment and enlarge the diameter of the opening 37 and change the straight slitted opening 38 to an approximately circular configuration. The axially inward force exerted by the wearer compels the tube to pass entirely through both sealing members 31, 32 and project beyond the same, whereby the annular marginal portions 37a and 38a of the openings 37 and 38 are resiliently stretched and flexed axially inward of the closure in continuous contacting sealing relation with one another and with the tube 20 in the manner shown especially in FIG. 6.

The tube 20 of the container 39 can be conveniently withdrawn from the closure 17 by simply exerting manually an axial force in the direction towards the exterior of the helmet. Upon removal of the tube 20 the sealing members 31, 32 immediately retract and resiliently resume their normal undeformed substantially planar disposition with the circular opening 37 and the straight slitted opening 38 closed against leakage by the coaction of the contacting central sealing portions of said members.

The modified closure structure 40 shown in FIG. 7 is constructed and arranged like the closure structure 17 shown in FIGS. 3 and 5 except that both openings 41, 42 in the transverse sealing members are circular and of the same diameter and equally spaced to opposite sides of a diametral center line "A" of the members with the centers of both openings 41, 42 located on the diametral center line "B" perpendicular to the first said diametral center line. The sealing members of the closure structure 40 function substantially like the sealing members 31, 32 whereby the spaced-apart openings 41, 42 are brought into axial alignment and their marginal portions seal against the tube 20 by virtue of the resilient stretching, deformation and axial inward flexing of the sealing members, when the tube 20 is inserted forceably through the closure in the manner described hereinabove for the closure structure 17. The closure structure 40 also provides an effective seal when the tube 20 does not extend through the structure.

The modified construction 45 shown in FIG. 8 is substantially like that of the closure structure 17 except each of the transverse sealing members has a straight slitted opening 46 and 47. These openings 46, 47 are of equal length and equally spaced from a diametral center line "A" of the sealing members and extend in parallel relation to such center line and to one another. The closure structure 45 including the said transverse sealing members thereof functions in substantially the same manner as the closure structure 17 to effect a seal at the marginal portions defining the openings 46, 47, when the rigid tube 20 is forced through the openings 46, 47 in the sealing members into the interior of the helmet. The closure structure 45 also provides an effective seal when the tube 20 does not extend through the structure.

The helmet with the closure structure 17, for example, mounted in the visor portion 16 as shown in FIGS. 9 and 10, makes possible the smoking of a cigarette 48 or a cigar during flight at high altitude. To this end, the tube 20 constitutes an element of means 52 for engaging and holding a cigarette or cigar and for conducting the smoke from the burning cigarette or cigar. The means 52 comprises a rigid tube 20 of metal or plastic material having a bore therein extending from the open mouth end portion 20a through an intermediate portion 20b and terminating in a counterbore 20c in an opposite enlarged open end portion 20d of the tube 20. This provides an internal annular shoulder 20e at the juncture of the enlarged end portion 20d and the intermediate portion 20b. The enlarged end portion 20d receives and holds an end portion of the cigarette or cigar 48.

A rigid centrally apertured partition member 49 of hard rubber or other rigid plastic material is disposed transversely of the counterbore 20c at the shoulder 20e and secured as by a suitable adhesive to the enlarged open end portion 20d. The apertured partition member 49 provides an annular seating surface 49a at its axially inner face. A second rigid apertured member 50 of hard rubber, for example, is disposed in the uniform bore of the intermediate portion 20b and secured to the wall thereof as by a suitable adhesive so that the members 49 and 50 are in axially spaced-apart fixed relation.

A movable rigid sphere 51 of suitable corrosion-resistant metal, for example, is disposed in the uniform bore in the intermediate portion 20b and adapted to abut and seal against the seating surface 49a of the member

49. A coiled compression spring 53 of suitable metal extends between the sphere 51 and the member 50 and resiliently urges the sphere 51 against the seating surface 49a. This arrangement prevents the release of the internal fluid pressure and the outward flow of gaseous fluid from within the helmet 15 through the means 52 when the open end portion 20a is not within the wearer's mouth; but permits the flow of smoke to the wearer when the latter applies suction to the open end portion 20a of the tube 20. When the smoke is exhaled by the wearer into the space within the helmet, the smoke is exhausted into the flying suit and thence to the outside of the suit, but the means for effecting such functions constitutes no part of the invention and accordingly is not shown.

The construction and arrangement of the means 52 permits the cigarette or cigar to be lighted, if desired, before the tube 20 is inserted through the closure structure 17 and then into the mouth of the wearer, and avoids an outward rush of gaseous fluid under pressure which would burn the tobacco before the cigarette or cigar could be smoked. The tube 20 of means 52 is inserted and withdrawn in the manner described hereinabove, and when inserted, the sealing members 31, 32 effect the required seal against the tube as shown in FIGS. 9 and 10.

Variations such, for example, as provision of an access opening and its associated closure structure in a location other than the visor for temporarily admitting a rigid tube or other element through the wall of the helmet for purposes other than feeding, drinking and smoking, e.g., the provision of a further air supply in case of emergency, may be made without departing from the scope of the invention as it is defined in the following claims.

I claim:

1. A helmet of generally domed configuration for attachment to a flying suit so as to entirely enclose the wearer's head and adapted to be maintained at an internal fluid pressure exceeding that of the ambient atmosphere, said helmet including at its front a visor portion of rigid transparent material with an access aperture therethrough at its lower region for positioning in front of the wearer's face with said aperture adjacent the mouth of the wearer, and penetrable sealing closure means mounted in said aperture in united sealing relation to said visor portion, said closure means including a transverse substantially planar sealing wall member of highly resilient elastomeric material divided intermediate its thickness throughout at least a central area thereof spaced from the periphery thereof providing a pair of superimposed substantially planar sealing portions of said elastomeric material, said sealing portions having adjacent substantially flat surfaces in continuous contact, when said wall member is in normal position, one of said sealing portions having an opening therethrough covered by the said flat surface of the other sealing portion and spaced from one side of a center line extending transversely of said wall member and the other sealing portion having an opening therethrough covered by the said flat surface of the first-mentioned sealing portion and spaced from the other side of the said transverse center line when said wall member is in said normal position, both said openings being brought temporarily into alignment and both marginal portions defining said openings being flexed in sealing contact with one another and with a rigid tube by virtue of resilient stretching and deformation of said sealing portions of the sealing wall member when the rigid tube is inserted through both said openings from the outside of the helmet and thereby penetrating said closure means.

2. A helmet of generally domed configuration for attachment to a flying suit so as to entirely enclose the wearer's head and adapted to be maintained at an internal fluid pressure exceeding that of the ambient atmosphere, said helmet including a rigid wall portion with an

access aperture therethrough, and a penetrable sealing closure structure closing said aperture in said wall portion, said closure structure comprising a rigid tubular housing having a bore therethrough and a continuous annular wall disposed within said access aperture and secured in contacting sealing relation to the helmet wall portion, said housing having a continuous annular internal radial flange spaced from an end thereof with an annular bead-receiving recess in the radially outer region of the axially inner surface of said flange, holding means within said bore in overlapping spaced relation to said flange and detachably engaging said wall of the housing, said holding means including a continuous annular element providing in its axially inner surface a continuous annular bead-receiving recess opposite the said recess in said flange, and a substantially planar sealing wall member of highly resilient elastomeric material disposed transversely of said bore in the space between said flange and said holding means with peripherally-extending continuous bead portions of said sealing wall member seated in said recesses in contacting sealing relation to the walls thereof thereby holding said sealing wall member within said housing to close said bore therein, said sealing wall member being divided substantially midway its thickness and throughout at least the major part of its area providing a pair of superimposed substantially planar sealing portions of said elastomeric material, said sealing portions having adjacent substantially flat surfaces in continuous contact when said wall member is in normal position, one of said sealing portions having an opening therethrough covered by the said flat surface of the other sealing portion and spaced from one side of a center line extending transversely of said sealing wall member and of said bore in the housing and the other sealing portion having an opening therethrough covered by the said flat surface of the first-mentioned sealing portion and spaced from the other side of the said transverse center line when said wall member is in said normal position, both said openings being brought transversely into axial alignment and both marginal portions defining said openings being flexed in sealing contact with one another and with a rigid tube by virtue of resilient stretching and deformation of said sealing portions of the sealing wall member when the rigid tube is inserted through both said openings from the exterior of the helmet and thereby penetrating said closure structure.

3. A helmet of generally domed configuration for attachment to a flying suit so as to entirely enclose the wearer's head and adapted to be maintained at an internal fluid pressure exceeding that of the ambient atmosphere, said helmet including at its front a visor portion of rigid transparent material with an access aperture therethrough at its lower region for positioning in front of the wearer's face with said aperture adjacent the mouth of the wearer, and a penetrable sealing closure structure closing said aperture in said visor portion, said closure structure comprising a rigid tubular housing having a bore therethrough and a continuous annular wall disposed within said access aperture and secured in contacting sealing relation to said visor portion, said annular wall having an annular internal radial flange in said bore at one end of said housing with a continuous annular bead-receiving recess in the axially inner surface and radially outer region of said flange, a continuous annular retaining washer in said bore in overlapping spaced relation to said flange and having a continuous annular bead-receiving recess in its axially inner surface and radially outer region and in axial alignment with said recess in the flange, a pair of superimposed sealing members of highly resilient rubbery material and substantially planar disk configuration with superimposed substantially flat surfaces in continuous contact when said members are in normal position, said members being disposed transversely of said bore in the space between said flange and said retaining washer, and means detachably engaging said housing and said washer to hold the latter

and said sealing members in the housing, each sealing member including an integral bead portion of said resilient rubbery material extending continuously about its entire periphery and seating in the adjacent recess in contacting sealing relation to the wall thereof, one sealing member having an opening therethrough covered by the said flat surface of the other member and spaced from one side of a diametral center line of the member and the other sealing member having an opening therethrough covered by the said flat surface of the first-mentioned member and spaced from the other side of the said diametral center line when the members are in said normal position, both said openings being brought into axial alignment and both marginal portions defining said openings being flexed in sealing contact with one another and with a rigid tube by virtue of resilient stretching and deformation of said members when the rigid tube is inserted through both said openings from the exterior of the said helmet and thereby penetrating the said closure structure.

4. A helmet of generally domed configuration for attachment to a flying suit so as to entirely enclose the wearer's head and adapted to be maintained at an internal fluid pressure exceeding that of the ambient atmosphere, said helmet including at its front a visor portion of rigid transparent material with an access aperture therethrough at its lower region for positioning in front of the wearer's face with said aperture adjacent the wearer's mouth, penetrable sealing closure means mounted in said aperture in sealing relation to said visor portion and including a transverse deformable sealing wall member of highly resilient rubbery material having a pair of normally spaced openings in temporary alignment, and means including a rigid tube insertable through said openings in the wall member and adapted for engaging a source of fluid located adjacent and exterior of the helmet, said tube when inserted through the wall member, being in removable relation thereto extending from the exterior of the helmet through the temporarily aligned openings in said sealing wall member with marginal portions defining said openings resiliently stretched and deformed and flexed in sealing contact with one another and with the tube and said tube terminating within the interior of the helmet in an open end portion adapted to be disposed in the wearer's mouth, said transverse sealing wall member in its normal position and non-deformed condition being generally planar and divided intermediate its thickness throughout at least a central area thereof spaced from the periphery thereof providing generally planar sealing portions of said rubbery material having adjacent substantially flat surfaces thereof in superimposed contact with one of said openings extending through one of said sealing portions and closed by said flat surfaces of the other sealing portion and arranged in transversely spaced relation to the other of said openings extending through the other sealing portion and closed by said flat surface of said one sealing portion, said sealing portions being resiliently stretchable and deformable to permit the temporary alignment of said openings when said tube is inserted from the helmet exterior through said sealing wall member of the closure means.

5. A helmet defined in claim 4 in which said means for engaging a source of fluid comprises said rigid tube having a bore therein extending from said open end portion through an intermediate portion of the tube and terminating in a counterbore in an opposite enlarged open end portion of said tube to provide an internal annular shoulder at the juncture of said enlarged end portion and said intermediate portion, a rigid centrally apertured partition member disposed transversely of said counterbore at said shoulder and united with the wall of the tube and providing an annular seating surface at the axially inner face of said member, a second rigid apertured member in said bore secured to said intermediate portion in spaced relation to the said partition member, a movable rigid sphere in said bore adapted to abut said seating surface, and a coiled compression spring extending between said

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sphere and said second member resiliently urging said sphere against said seating surface thereby preventing the release of the fluid pressure and outward flow of fluid from within said helmet, but permitting flow of fluid to the wearer when the latter applies suction to said tube.

6. A penetrable sealing closure structure for an access opening in a rigid wall of a flying suit helmet adapted to permit a tube to be temporarily inserted through and withdrawn from the said closure structure by operation externally of the helmet and adapted to seal against the inserted tube when the helmet is under an internal fluid pressure greater than that externally of the helmet, said closure structure comprising a tubular housing having a bore therethrough providing a continuous annular wall with an annular internal radial flange in said bore at one end of the housing, said internal radial flange having a continuous annular bead-receiving recess in its axially inner surface and radially outer region, a sealing member of highly stretchable resilient rubbery material and planar disk configuration with a thickness substantially less than its diameter disposed transversely of said bore in contact with said internal flange, said sealing member having at one planar face thereof an integral bead portion projecting axially and extending continuously about the circumference of the member and seated in and contacting the wall of said recess, a separate second sealing member of highly stretchable resilient rubbery material and planar disk configuration with a thickness substantially less than its diameter disposed transversely of said bore with one planar face thereof in superimposed continuous contacting relation to the adjacent planar face of the first said sealing member throughout the area thereof when the members are in normal position, said second sealing member having at the other planar face thereof an integral bead portion projecting axially and extending continuously about the circumference of said second member, the first said sealing member having a circular tube-receiving opening therethrough closed by the adjacent planar face of said second member and spaced from one side of a diametral center line of the member and the said second sealing member having a tube-receiving opening of straight slit configuration therethrough closed by the adjacent planar face of said first member and spaced from the opposite side of and parallel with the said diametral center line and spaced from said circular tube-receiving opening when the members are in normal position, said circular opening and said slitted opening being adapted to be brought into temporary axial alignment with both marginal portions defining the said openings axially flexed in sealing contacting relation to one another and to a rigid tube by virtue of resiliency, stretchability and deformability of the members when the said tube is temporarily inserted through both openings in said sealing members thereby penetrating the closure structure, a continuous annular retaining washer with a central opening therethrough superimposed upon and contacting said second sealing member, said retaining washer at its radially outer region having a continuous annular portion constructed and arranged to receive and contact said bead portion of said second sealing member, and means detachably engaging said housing and said retaining washer thereby holding said sealing members including said bead portions in sealing contact with said housing and said retaining washer.

7. A penetrable sealing closure structure for an access opening in the wall of a flying suit helmet, said closure structure comprising a rigid tubular housing with an axial bore therethrough and an annular flange extending radially inward in said bore at one end of the housing providing a continuous annular recess at the radially outer region of the axially inner surface of the flange, an annular retaining washer in said bore in overlapping spaced relation to said flange with the radially outer portion of the washer axially offset relative to the radially inner portion thereof thereby providing a continuous annular

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recess in axial alignment with and opposite said recess in the flange, a pair of superimposed sealing members of highly resilient rubbery material and planar disk configuration with superimposed adjacent substantially flat surfaces in continuous contact when the members are in normal position, said members being disposed transversely of said bore in the space between said flange and said retaining washer, and means detachably engaging said housing and said retaining washer to hold the latter and said sealing members in the housing, each sealing member including an integral bead portion of said resilient rubbery material extending continuously about its entire periphery and seating in the adjacent recess in contacting sealing relation to the wall thereof, one sealing member having an opening therethrough closed by the said flat surface of the other member and spaced from one side of a diametral center line of the member and the other sealing member having an opening therethrough closed by the said flat surface of said one member and spaced from the opposite side of said diametral center line when said members are in normal position, both said openings being brought into axial alignment and both marginal portions defining said openings being axially flexed in sealing contact with one another and with a rigid tube by virtue of resilient stretching and deformation of said sealing members when the rigid tube is inserted through both said openings and thereby penetrating said closure structure.

8. A helmet of generally domed configuration for attachment to a flying suit so as to entirely enclose the wearer's head and adapted to be maintained at an internal fluid pressure exceeding that of the ambient atmosphere, said helmet including a rigid wall portion with an access aperture therethrough, and a penetrable sealing closure structure closing said aperture in said wall portion, said sealing closure structure comprising a pair of resilient, elastomeric, superimposed sealing members with superimposed substantially flat surfaces in contact one to the other and with a separate opening in each member and with said openings out of alignment, when the members are in normal position, so that the closure structure is rendered air-tight by contact of said flat surfaces on the members, said sealing members being elastically deformed by sequential insertion of an element through the openings in said members from the exterior of said helmet to bring the openings into alignment to permit the said element to be pushed through said openings, thereby penetrating the closure.

9. A penetrable sealing closure structure comprising a pair of similarly resilient elastomeric superimposed sealing members each including a flat surface disposed transversely of the closure structure with the flat surfaces of the sealing members in superposed contact one to the other and with a separate opening through each member in a portion thereof having said flat surface and with said openings out of alignment, when the members are in normal position, so that the closure structure is rendered airtight by contact of said flat surfaces on the members, the thickness of each of said sealing members being less than the least transverse dimension of the closure structure so that both members are elastically deformed by sequential insertion of an element through the openings in said members to bring the openings into alignment to permit the said element to be pushed through said openings, thereby penetrating the closure.

10. A penetrable sealing closure structure as defined in claim 9 in which one of said openings is spaced from and located wholly to one side of a line which extends transversely of the closure structure, and the opening in the other sealing member is spaced from and located wholly to the opposite side of said line.

11. A penetrable sealing closure structure as defined in claim 9 in which one of said openings is circular and is spaced from and located wholly to one side of a line which extends transversely and centrally of the closure structure, and the opening in the other sealing member is

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a straight slit which is spaced from and located wholly to the opposite side of said line.

12. A penetrable sealing closure structure comprising a rigid tubular housing provided with axially spaced facing annular recesses, and a pair of resilient elastomeric superimposed sealing members of flat disk shape each including a flat surface disposed within and transversely of said tubular housing with the flat surfaces of the sealing members in superposed contact one to the other and with a separate opening through each member in a portion thereof having said flat surface and with said openings out of alignment, when the members are in normal position, so that the closure structure is rendered airtight by contact of said flat surfaces on the members, each of said sealing members being provided with a peripherally extending annular bead in the non-contacting surface of the member, each annular bead being seated in one of said annular recesses in said tubular housing, and the thickness of each of said sealing members being less than the least transverse dimension of the closure structure so that the members are elastically deformed by sequential insertion of an element through the openings in said members to bring the openings into alignment to permit the said element to be pushed through said openings, thereby penetrating the closure.

13. A penetrable sealing closure structure comprising a pair of resilient elastomeric superimposed sealing members each including a flat surface disposed transversely of the closure structure with the flat surfaces of the sealing members in superposed contact one to the other and with a separate opening through each member in a por-

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tion thereof having said flat surface and with said openings out of alignment, when the members are in normal position, so that the closure structure is rendered airtight by contact of said flat surfaces on the members, the thickness of each of said sealing members being less than the least transverse dimension of the closure structure so that the sealing members are elastically deformed by sequential insertion of an element through the openings in said members to bring the openings into alignment to permit the said element to be pushed through said openings, thereby penetrating the closure, and a rigid tubular housing including means detachably mounting the sealing members within and transversely of the tubular housing, said housing including guide means for guiding said element into the said opening in one of said sealing members.

References Cited in the file of this patent

UNITED STATES PATENTS

183,521	Weck	Oct. 24, 1876
1,366,437	Wagenhorst	Jan. 25, 1921
2,011,562	Crowley	Aug. 20, 1935
2,151,466	Eken	Mar. 21, 1939
2,183,900	Voit et al.	Dec. 19, 1939
2,589,716	Marsh	Mar. 18, 1952
2,667,986	Perelson	Feb. 2, 1954
2,689,564	Adams et al.	Sept. 21, 1954
2,755,060	Twyman	July 17, 1956
2,757,843	Smith	Aug. 7, 1956
2,761,593	Spiess et al.	Sept. 4, 1956
2,857,911	Bennett	Oct. 28, 1958