

Oct. 20, 1970

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3,534,408

DIVING HAT NECK SEAL AND SUIT ATTACHMENT

Filed Jan. 17, 1968

2 Sheets-Sheet 1

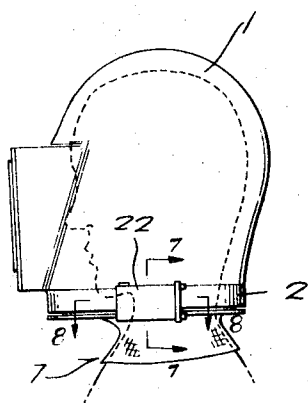


Fig. 1

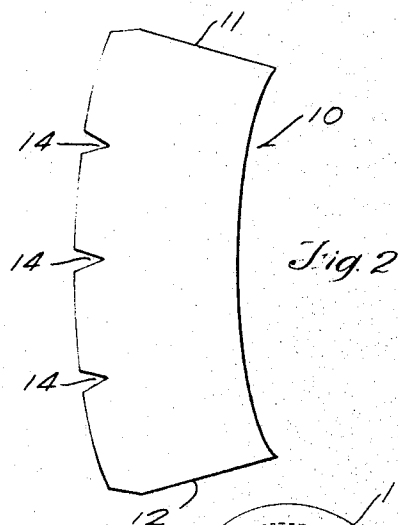


Fig. 2

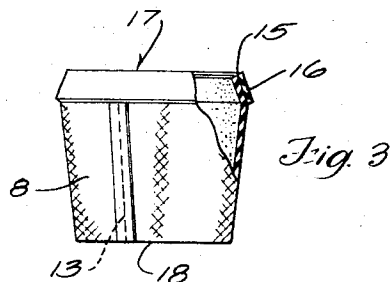


Fig. 3

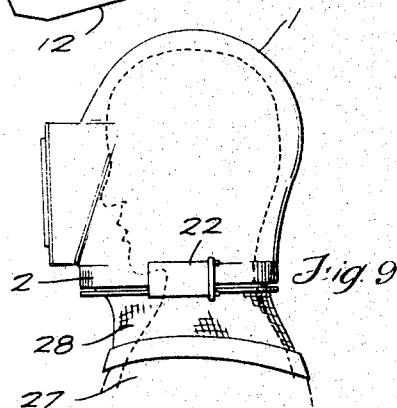


Fig. 9

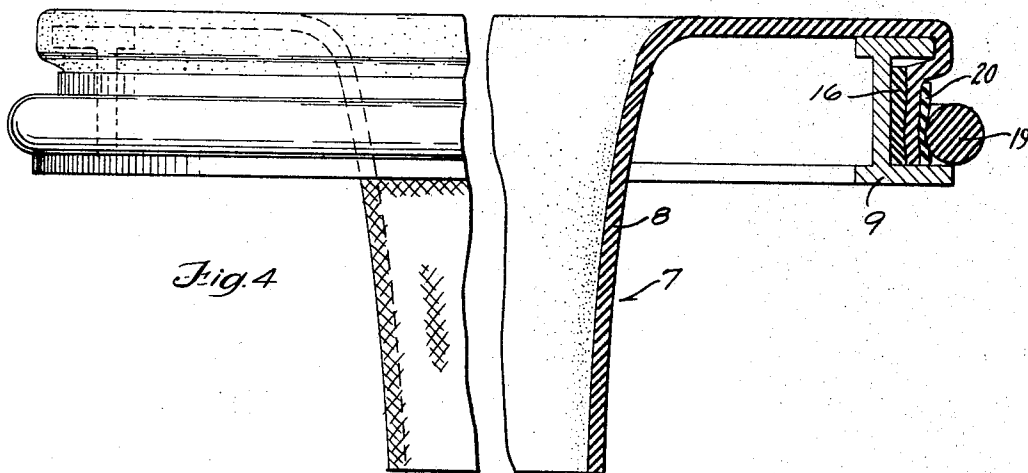


Fig. 4

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2 Sheets-Sheet 2

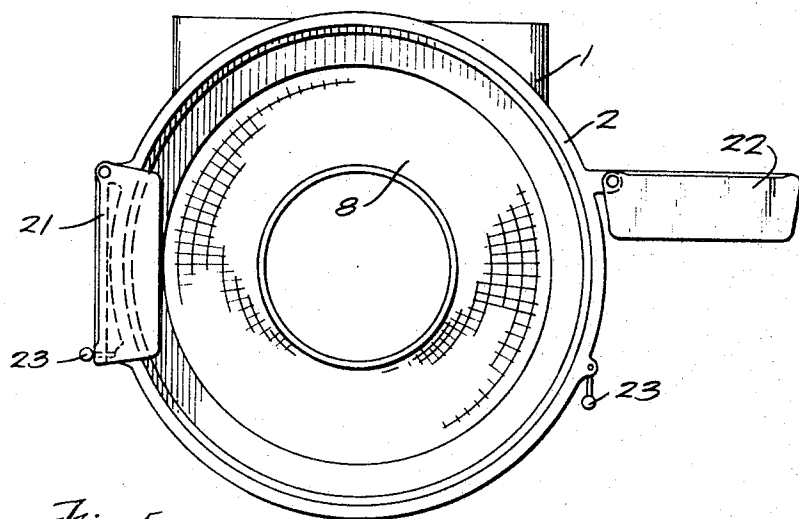


Fig. 5

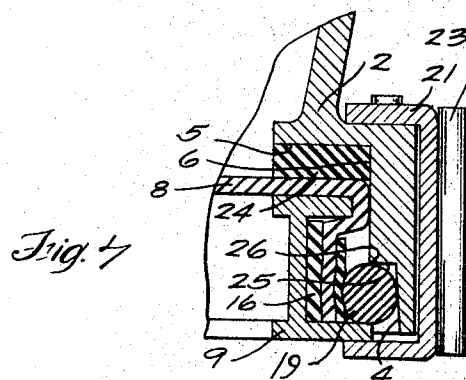


Fig. 7

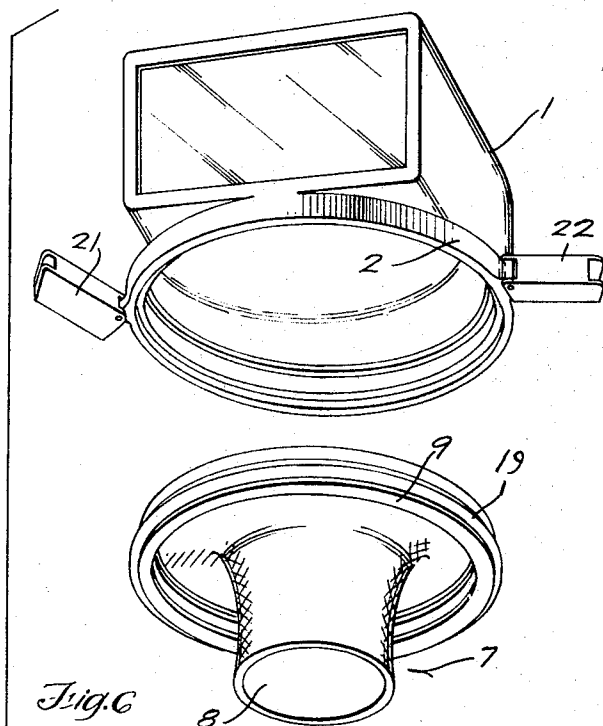


Fig. 6

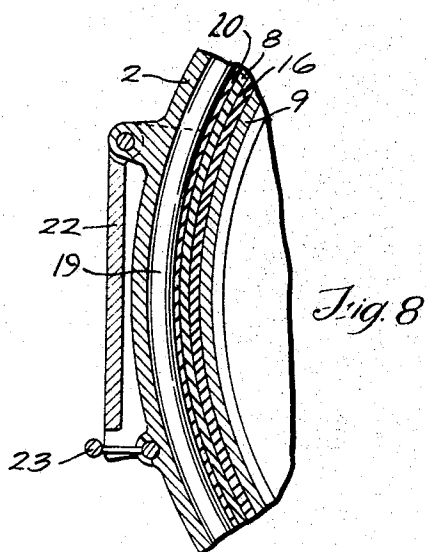


Fig. 8

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1

3,534,408

DIVING HAT NECK SEAL AND SUIT ATTACHMENT

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Filed Jan. 17, 1968, Ser. No. 698,493

Int. Cl. B63c 11/02

U.S. Cl. 2—2.1

11 Claims

ABSTRACT OF THE DISCLOSURE

The diving hat or helmet is supported on the diver's head leaving a circular base or neck ring radially spaced from the diver's neck. The circular base has an inward and downwardly facing recess formed by an outward circumferential flange which in turn has a downwardly extending flange at its outer edge with a downwardly tapered inner surface. A circumferential shoulder is provided in the recess for engagement with a sealing O-ring. An outwardly facing channel ring is adapted to be received in the recess of the helmet base and to be secured therein by two side channels hinged at one end to the helmet base to close over the recess when the ring is in place. A watertight seal between the diving hat and the neck of the diver is provided by a stretchable rubber neckpiece of special quasi-cylindrical shape having a double thickness edge portion stretched over the upper flange of the channel ring and disposed in the bottom of the channel, the lower end of the neckpiece being adapted to fit snugly around the diver's neck. The upper edge portion of the neckpiece extends upwardly through the channel ring and is stretched outwardly and over the top of the channel with the downwardly folded edge disposed in the bottom of the channel where it is retained by its own elasticity. A stretchable solid rubber O-ring having an outside diameter approximately equal to the least inside diameter of the tapered inner surface of the helmet or hat, holds the edge of the neck piece in the channel and presses against the shoulder and the slanting inner surface of the downward flange of the helmet base. A ring shaped gasket of readily compressible rubber is disposed between the ring assembly and the outward flange of the helmet base, and the neckpiece extends between the ring and the block. The inner portion of the neckpiece extends downwardly around the neck of the diver and is stretchable for assembly of the helmet over the head of the diver. When used as a diving helmet the water pressure upon the neckpiece and the several seals tends to maintain the seals.

Instead of using a separate neckpiece, as described above, a similar seal may be made using the stretchable rubber neck of a diving suit, in which case a water-tight seal is achieved between the diving hat and the diving suit in such manner that, by varying the atmospheric pressure in the diving hat, the diving suit can be inflated or deflated in order to vary the buoyancy of the diver.

This invention relates to a diver helmet neck seal and suit attachment particularly useful for underwater divers and more particularly to a mode of attaching a diving hat to a neckpiece or diving suit so as to achieve a safe, strong and watertight seal.

Until recently diving helmets have consisted of a helmet itself and a breastplate. The breastplate is bolted in a watertight fashion to the top of the diving suit where its weight rests upon the diver's shoulders. Both the helmet and the breastplate are equipped with mating rings having interrupted screw threads. The helmet is donned by placing the helmet ring over the breastplate ring and giving the helmet a quarter turn, engaging the

2

interrupted screw threads, and causing the bottom surface of the helmet ring to seal against a leather gasket contained in the breastplate ring. Both the helmet and the breastplate then rest on the diver's shoulders and the diver's head is free to turn inside the helmet.

Recently lighter weight diving hats have been produced which rest upon the diver's head and turn with his head. The same general method of producing a seal between a helmet and breastplate, as described above, has been carried over and utilized to provide a seal between such diving hat and either a diving suit or a separate neckpiece. This has been accomplished by again equipping both the diving hat neck ring and a separate metal ring with interrupted screw threads and providing one of them with a leather or rubber gasket against which the other can make a seal. Separate neckpieces as provided for such diving hats have consisted of a flat disk of rubber sheet with a hole in the center, and with a cylinder of rubber sheet projecting downwards from and bonded to the edges of said center hole. The separate neckpiece (so constructed) has then been attached to the metal ring by compressing its outside edge between the metal ring and a ring-shaped metal plate of similar dimensions using a number of threaded screws which penetrate through the plate and the neckpiece material into the metal ring. Such metal rings have also been used to make a seal with the neck of a diving suit by compressing the material of the suit between the plate and the ring in the same manner.

The existing method of sealing, as described above, therefore involves two separate and independent seals, one between the helmet and the metal ring and the other between the metal ring and the neckpiece and suit material. The second such seal, in particular, is very difficult and time consuming to assemble and disassemble and has the further serious disadvantage that the material of the neckpiece or diving suit is perforated by screws in the process of assembly and is thereby weakened and ultimately worn out and destroyed.

The present invention constitutes a wholly new approach to this sealing problem whereby the neckpiece or suit material itself is utilized as part of the seal and whereby the need for screw threads and threaded fasteners is wholly eliminated. It provides a simple construction of low cost which allows for greatly increased ease of assembly, and which is safe and practical in use. It can be assembled without any perforation of the neckpiece or suit material.

In carrying out the invention a separate elastic neckpiece of special design is utilized, so constructed that, when its upper edge is stretched out over the top of an outwardly facing channel ring and secured in its channel, the neckpiece deforms under tension and assumes the general shape of neckpieces presently in use. At the same time the elasticity of the upper edge of the neckpiece causes it to retain itself in the channel. A rubber O-ring is then placed over the neckpiece in the channel and the assembly of the neckpiece to the channel ring is complete, except that, if desired, one or more rubber bands or shims can be placed between the neckpiece material and the O-ring for the purpose of further securing the neckpiece to the channel ring and increasing the outside diameter of the O-ring to achieve an optimum seal. The rubber neck of a diving suit can be assembled to the channel ring in the same manner.

The diving hat has, in its neck ring, a complementary circumferential recess of unique and novel design which receives the channel ring and neckpiece assembly. When the channel ring and neckpiece assembly is confined within the helmet neck ring, four separate and complementary water-tight seals are thereby accomplished. The first such seal is accomplished by the material of the

3

neckpiece itself, where it is stretched over the top of the neck ring recess. The second such seal is accomplished by the outside of the O-ring being pressed against the tapered wall at the bottom of the neck ring recess while its inside presses the neckpiece material against the vertical surface of the channel ring channel. The third such seal is accomplished by the top of the O-ring being pressed against the horizontal shoulder machined in the neck ring recess. The fourth such seal is accomplished by the bottom of the O-ring being pressed against the bottom horizontal surface of the channel ring.

A pair of side channel members or clamps are hinged to opposite sides of the helmet neck ring so as to straddle the neck ring and confine the channel ring and neckpiece assembly inside the diving hat neck recess thus accomplishing the various seals described above. A safety latch holds the channel clamps in closed position. The channel clamps and latches are designed so that they can easily be closed or opened by a diver even when his hands are cold and encased in heavy gloves.

The drawings illustrate the best mode of carrying out the invention.

In the drawings:

FIG. 1 is a side elevation of the diver's hat mounted on the head of a diver;

FIG. 2 is a plan view of elastic material from which the neck piece is formed;

FIG. 3 is a side elevation of the neck piece with a part broken away and sectioned to show the construction;

FIG. 4 is an enlarged detail side elevation of a neck piece assembled upon the channel ring and with a part broken away and sectioned to show the construction;

FIG. 5 is a bottom plan view of an assembled diving hat and neck seal showing one securing channel member closed and locked and the other securing channel member open;

FIG. 6 is a perspective view of the diving hat and neck seal ready to be assembled apart from the diver;

FIG. 7 is an enlarged detail transverse section showing the securing of the diving hat and neck seal in assembled relation;

FIG. 8 is an enlarged detail section of the assembly taken at right angles to that of FIG. 7; and

FIG. 9 is a side elevation similar to FIG. 1 and showing the connection of the diving hat with the neck piece of a diver's suit.

Referring to the drawing, the diving hat or helmet 1 which may be of cast aluminum alloy has a circular base 2.

The base 2 has an inwardly facing frusto-conical or inclined surface 4 and a shoulder 5 at the top, thereby providing a circumferential inward and downward facing recess 6 for receiving the neck seal 7.

The neck seal 7 comprises a neckpiece 8 preferably formed of foam rubber, neoprene, or other suitable stretchable material to encircle the neck of the diver, and an outwardly facing channel ring 9 over the upper flange of which the upper edge portion of the neckpiece 8 is stretched.

It has been found that a suitable neckpiece 8 may be formed from a flat blank 10 illustrated in FIG. 2 and which is then rolled into a tubular shape and its ends 11 and 12 suitably cemented together along a longitudinal seam 13. The notches 14 in the upper edge of blank 10 are brought to a close and cemented as at 15 when the blank is rolled to tubular shape. A reinforcing layer 16 of similar foam material may be applied and cemented to the closed notch end of the tubular neckpiece thus formed. The resulting neckpiece 8 is of two opposed generally frustoconical sections 17 and 18 providing a tapering of the tubular neckpiece towards opposite ends.

When the upper end 17 of the neckpiece 8 is stretched over the upper rim of channel ring 9, the heavier section

4

formed by layer 16 lies in the bottom of the channel and tends to retain the assembly.

The assembly of the neck seal 7 is completed by application of a stretchable rubber means to the channel ring 9 to additionally confine the upper end 17 of neckpiece 8 in the channel. Such a stretchable rubber means comprises an O-ring 19 and may additionally comprise a rubber band 20 applied beneath the O-ring.

The neck seal 7 thus assembled is then slipped over the head of the diver, the lower end 18 of the neckpiece stretching for this purpose and then elastically contracting gently upon the neck of the diver.

After assembly of the neck seal 7 upon the diver, the helmet or hat 1 is applied over the diver's head and the channel ring 9 is pressed upwardly into recess 6 thereby confining the O-ring 19 in the channel and against the internal tapered surface 4 of the hat base 2.

The entire assembly is then secured by two channel members 21 and 22 hinged to opposite sides of base 2 and which close upon the base as illustrated in FIGS. 5 and 7. After closing of the channel members 21 and 22, each is latched closed by means of a latch member 23 pivoted to the outer side of base 2 and adapted to swing over the free end of the corresponding channel member to prevent its accidental displacement from closed position.

The complete assembly provides a self energizing seal between the neck seal 7 and the helmet 1 as illustrated in FIG. 7. The water pressure tends to force the channel ring 9 upwardly in recess 6, thereby squeezing O-ring 19 against the tapered surface 4 and increasing the pressure of the O-ring against the end portion 17 of the neckpiece 8 within the channel ring.

In addition a gasket ring 24 of foam rubber or neoprene is preferably disposed against shoulder 5 in recess 6, and serves to provide a cushion seat for the channel ring 9 with a portion of neckpiece 7 confined between the channel ring 9 and the ring 24 to effect a further seal.

In order to prevent leakage under pressures encountered at substantial diving depths in the water, the inclined surface 4 of base 2 terminated in a second circumferential shoulder 25 positioned to provide a sharp corner 26 that bites or digs into the O-ring 19 and serves as a fixed seal about which the O-ring tends to roll or deform as it is pressed upwardly in recess 6 by the increased water pressure beneath.

The seal thus provided is self energizing and it prevents all access of water to the inside of the helmet. In effect a seal is provided between the O-ring 19 and the tapered surface 4, between the O-ring 19 and the shoulder corner 26, between the shoulder 5 and the gasket 24, between the gasket 24 and the surface of the neckpiece 8 engaging the same, between the O-ring 19 and the outer surface of portion 17 of neckpiece 8, between the layer 16 of portion 17 of neckpiece 8 and the channel ring 9, and between the neckpiece 8 and the channel ring 9 beneath gasket 24.

Disassembly and removal of the hat and seal is very simple. The diver only needs to push latches 23 from the ends of members 21 and 22, then swing channel members 21 and 22 outwardly upon their hinges and lift the hat off from his head. He can then readily pull the neck seal upwardly over his head and off.

The hat may be employed with a diving dress or suit in the same manner. Where an inflatable suit 27 is to be employed the upstanding neckpiece or collar 28 should be of rubber or other elastic material and it should be stretched over the top rim of channel ring 9 in the same manner as neckpiece 8.

In either case the neckpiece 8 or neckpiece 28 is sufficiently flexible to enable the diver to turn his head naturally in most all directions with the hat or helmet always following so that the glass front 29 is always directly in line with his eyes.

Various modes of carrying out the invention are contemplated as being within the scope of the following

5

claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In combination with a diving hat having a generally circular peripheral base adapted to surround the neck of a diver in spaced relation thereto with an inwardly and downwardly facing recess formed by a flat downwardly facing shoulder and a skirt depending therefrom and having an inner wall at least a portion of which is inclined inwardly and upwardly from the lower edge of said base, an outwardly facing generally circular channel ring positioned in said recess, a generally tubular flexible stretchable sealing member having its upper end extending upwardly through said channel ring and stretched over the top thereof with the immediate edge portion confined in the channel, an O-ring securing said sealing member in said channel ring and bearing against said inclined surface of said base, and releasable means carried by said base and securing said channel ring within said recess.

2. The construction of claim 1 and a second shoulder terminating the upper end of said inclined wall portion and extending inwardly from said skirt at a position spaced downwardly from said shoulder, said second shoulder presenting a sharp corner edge engaging said O-ring.

3. The construction of claim 1 and a resilient gasket member between said shoulder and the sealing member to provide for an increase in the effective seal by letting the O-ring ride up the inclined surface of the skirt as the water pressure increases with depth of diving.

4. The construction of claim 1 in which the body of said sealing member extends downwardly from said channel ring and is of substantially less diameter than said ring to constitute a stretchable tubular neckpiece adapted to fit the neck of the diver and to be self-sealing thereagainst by reason of the external water pressure encountered in diving.

5. The construction of claim 4 in which the neckpiece is of foam neoprene material having the necessary stretchability for assembly with the channel ring and for drawing the same over the head of the diver, and the necessary resilience to gently grip the neck of the diver.

6. The construction of claim 1 in which the sealing member constitutes an upstanding collar of a diving suit.

7. The construction of claim 6 in which the upstanding collar is of solid stretchable rubber and is adapted to be of generally larger diameter than the neck of the diver.

6

8. The construction of claim 1 in which said releasable securing means comprises one or more inwardly facing channel members hinged at one end to the base of the hat and having the opposite end free to swing inwardly to straddle the circular base of the hat with the lower flange of the channel member underlying the channel ring of the neck seal and thereby retaining the channel ring in the recess of said circular base.

9. The construction of claim 8 and a pivotal latch securing the free end of each said channel member against outward displacement after the helmet is assembled with the neck seal.

10. In a device of the class described a neckpiece comprising a flat blank of stretchable material of uniform width having its side edges substantially arcuate and its end edges generally tapering toward the center of the radii of the arcuate edges, the outermost side edge having a plurality of spaced V-slots therein and the end edges of the blank abutting and being secured together forming a generally frusto-conical tubular body for the neckpiece with the V-slots closed and gathering an upper end portion of the tubular body into a frusto-conical portion tapering oppositely from the remainder of said body, and means securing the closed edges of said V-slots together.

11. The construction of claim 10 in which a reinforcing strip is secured to said tapered upper end circumferentially of the neckpiece and serves additionally to guide the upper end of the neckpiece in determining the location thereof upon the neck ring.

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