Oct. 29, 1963 J. GASAWAY 3,108,283

BATHING CAP

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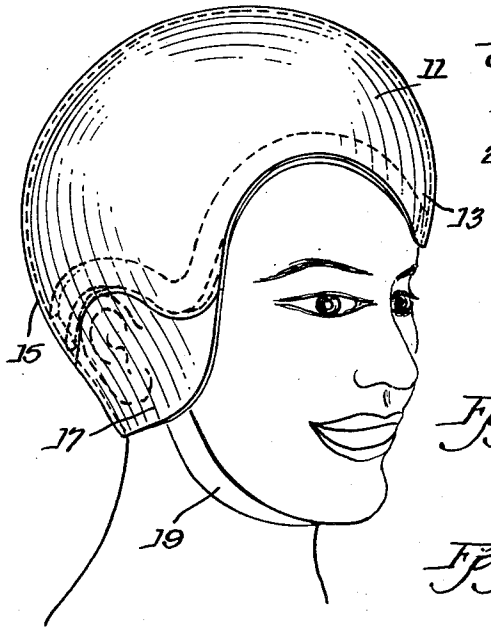


Fig. 1.

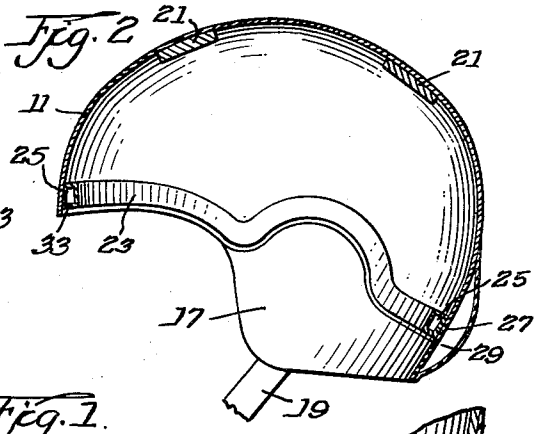


Fig. 2.

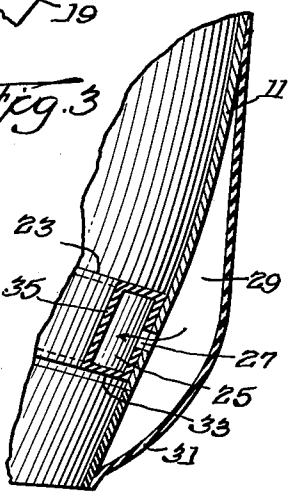


Fig. 3.

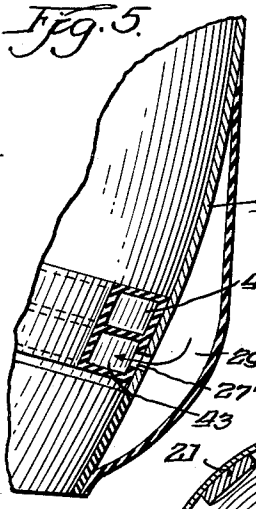


Fig. 5.

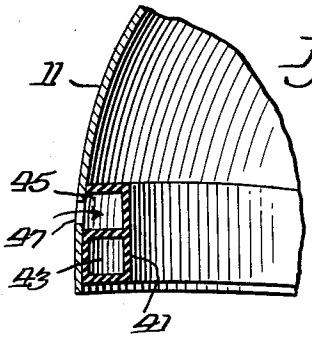


Fig. 6.

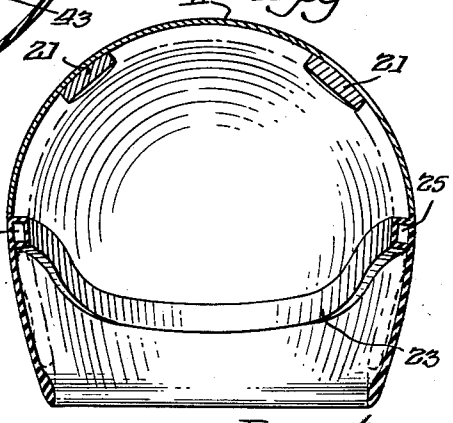


Fig. 4.

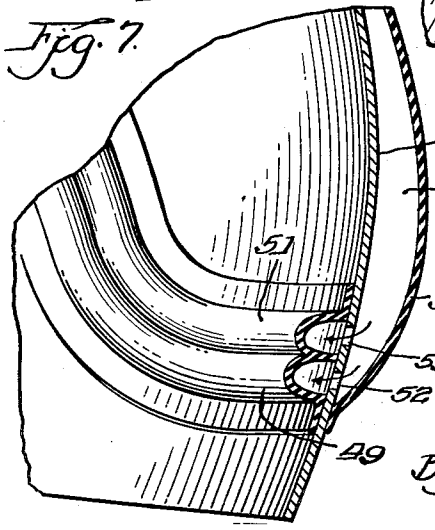


Fig. 7.

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Fig. 8.

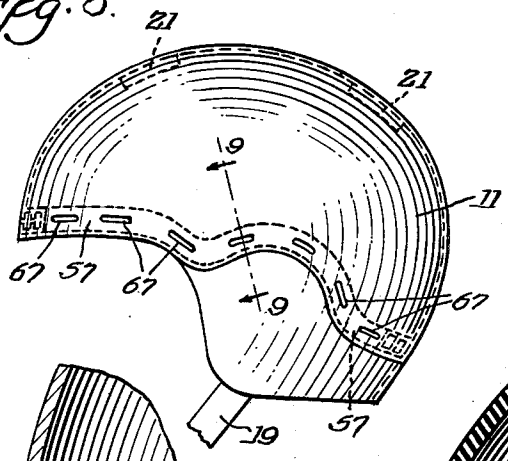
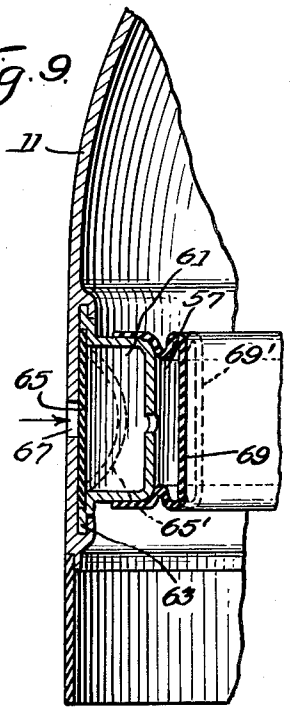
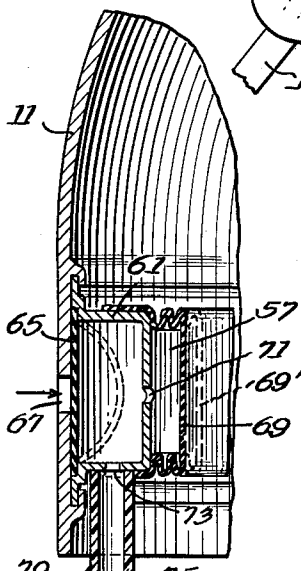


Fig. 9.





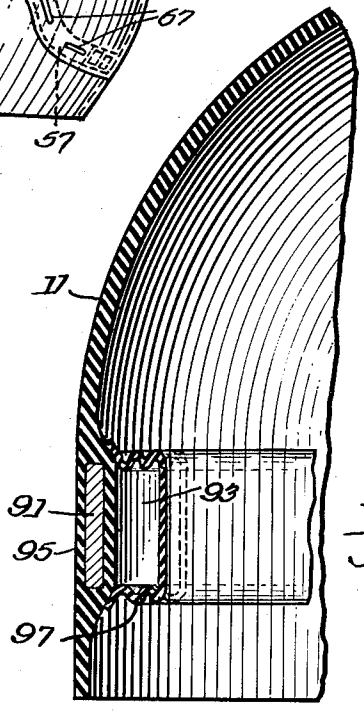


Fig. 11

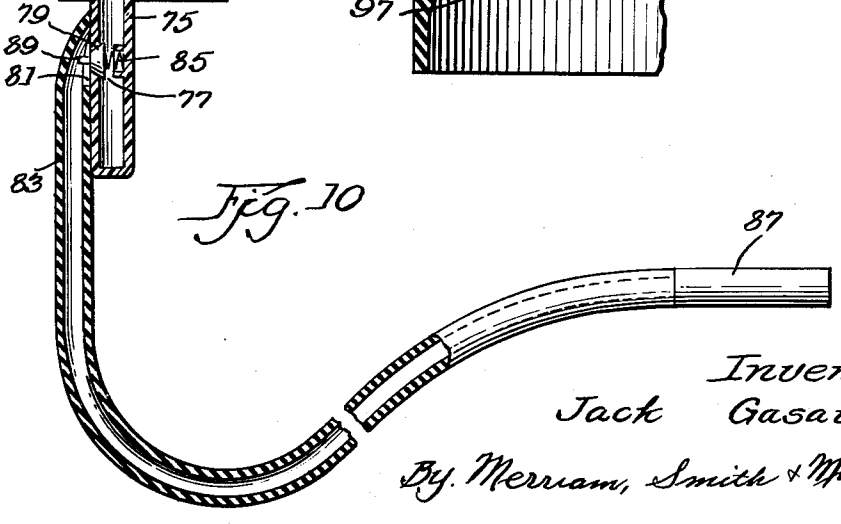


Fig. 10

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BATHING CAP

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10 Claims. (Cl. 2—68)

This invention relates to a non-leaking bathing cap by the use of which the swimmer's hair can be maintained in a dry state independently of the depth to and from which the swimmer may descend and rise.

Heretofore various attempts have been made to provide leak-proof bathing caps. Generally speaking, these have met with failure because of the fact that when the cap is pulled over the swimmer's head a certain amount of air remains in the cap until the head is submerged. At the time the head is submerged the water pressure on the outside of the cap forces some of the retained air out of the cap and compresses the balance of the air inside the cap. The deeper the swimmer's head is submerged the more air is forced out of the cap and the greater is the compression taking place on that air which remains in the cap.

Efforts to meet these objections by virtue of providing inflated bands extending within the cap and about the wearer's head met with negligible success. Various ways have been provided for inflating such bands and various forms of components to ease the effects of the bands upon the wearer's head have been tried. Prior art caps, except for cumbersome and heavy divers' helmets, so far as is known, have all been of the type formed of elastic material, rubberized fabric, rubber, or other flexible waterproof material generally formed and contoured so as to be shaped closely to the wearer's head when in use. In some instances, inflatable bands have been applied about the caps and the pressure within the band has been built up by means of an inflating ball or some similar instrumentality.

Nevertheless, it has been found that with the completely resilient form of covering structure whereby air is forced out of the cap, submersion of the wear produces sufficient pressure so that when the swimmer begins to rise from the maximum depth in the water which he has reached, the external pressure on the cap is released and there is a tendency of the cap to return to its original size, due primarily to the "springing" of the hair of the wearer. In so returning to its original size, the air which was forced out of the cap during submersion must be replaced, as a semi-vacuum has been created. As the swimmer rises from his maximum depth to the surface the pressure becomes less and less and in order to provide equalization inside and outside the cap some water enters the cap about its edges as the wearer rises from a submerged status since there is no other medium of equalization available.

According to the present invention the defects of the prior art are overcome by the use of a rigid cap or covering structure which may be maintained at a fixed spacing from the skull of the wearer. This region is sealed-off by a barrier pressure band which initially exerts a force only very slightly above atmospheric but which is subject to increase determined by the depth in the water to which the swimmer may move. Under such circumstances the water pressure, as the wearer submerges deeper and deeper, cannot decrease the air space between the cap and the head so long as the barrier sealing-off region of greater pressure is between the internal air space and the water.

The present invention provides such a pressurized barrier region about the head of the wearer and, generally

speaking, along the peripheral boundaries of the covering cap structure. This barrier region is initially established at a pressure just slightly above atmospheric, but, as the wearer submerges deeper and deeper, the pressure difference is adapted to be increased automatically to an extent such that it is greater than that of the water on the outside so that water is precluded from entering into the fixed air chamber. Likewise, when the wearer rises from a maximum depth in the water, the pressure differential at the barrier region between the free air space and the water will be reduced but will be greater than that at which the water tends to press inwardly of the covering structure, so that with the water being unable to decrease the air space between the covering and the skull of the wearer as the swimmer submerges, no internal vacuum is created and consequently no water is drawn into the cap as the wearer rises to the surface from a submerged position.

This is accomplished with the present invention by providing the cap or head-shaped outer structure as a rigid plastic or other generally helmet-shaped covering shaped substantially to fit the head of the wearer. Conformity to the shape of the skull is generally provided by internal skull spacers formed of plastic, rubber, or other types of elastic material. In some cases, however, rigid spacers may be used since their prime function is to keep the rigid dome at a fixed distance from the wearer's skull so that compression either will not occur or will be held to a minimum. Various ways may be provided to maintain a control of the pressure and to preclude leakage both upon submersion and upon rising from a submerged position to the surface.

The invention as herein described has included among its objects those of providing a cap or covering structure which will not only be comfortable and readily worn by the wearer, but which will also accomplish the desired function of maintaining the wearer's hair in a dry state without discomfort. Other objects of the invention are those of providing a water barrier or seal medium to prevent water entering into the helmet or covering and to maintain the effectiveness of the barrier at varying water depths. Still other objects and advantages of the invention includes those of providing a structure for use as a cap covering which is attractive, comfortably worn, capable of being marketed at a nominal price, and which is highly efficient in its use. Many other objects will suggest themselves when the following description and claims are considered together with the accompanying drawings which illustrate the invention in certain of its preferred forms.

By the drawings:

FIGURE 1 schematically illustrates one form of the cap covering in use;

FIGURE 2 is a sectional view of the cap structure of FIGURE 1 taken generally longitudinally through the cap element per se from front to back;

FIGURE 3 is an enlarged view of a portion of FIGURE 2 and is to illustrate a preferred method of providing automatically changing pressure within the boundary limits of the cap or helmet in accordance with existing external pressure effective on a fluid reservoir;

FIGURE 4 is a sectional view of the cap structure of FIGURE 1 looking in a direction substantially 90° to the position in which FIGURE 2 is shown and is taken along a line substantially through the center of FIGURE 2;

FIGURES 5 and 6 represent further modifications of the structure of FIGURE 3 and illustrate small sections of the cap structure, FIGURE 5 showing a somewhat similar pressure control to that of FIGURES 1–4 and showing pressure control in one of a pair of tubular components formed inside the helmet structure, and FIGURE 6 showing an inlet to provide in the second of a

pair of tubes at about the boundary of the head covering element an inlet for water thereby to maintain a pressure control within the helmet which will be proportional to the pressure exerted upon the helmet surface by the water;

FIGURE 7 is a modification and shows a portion of the helmet with pressure control effective along a plurality of internal contour bands;

FIGURE 8 is a modification to show a preferred form of helmet structure providing supplemental cushioning for the wearer, at the region of the boundary limits and barrier territory;

FIGURE 9 shows a modified arrangement of the diaphragm construction to control pressure build-up within the head-band surrounding the wearer;

FIGURE 10 is a modified arrangement to show a preferred form of head-band and provides inflating mechanism at the barrier region thereof combined with a suitable chin-strap for the wearer; and

FIGURE 11 is a modification of the pressure-control structure in the regions of the wearer's head-band barrier.

Referring now to the drawings for a further understanding of the invention, the helmet proper **11** is preferably formed of a substantially rigid plastic shell contoured generally to the head shape of the wearer and large enough to slip over the head. In this form the helmet is arranged to extend forwardly as at **13** to cover to a desired extent the forehead of the wearer. It is also arranged to extend downwardly at the rear, as at **15**, to a position substantially to the base of the skull at which the hairline generally terminates. The hard plastic material of which the helmet is formed is then preferably contoured to extend from the rear and along each side of the wearer's head just slightly above the ears to meet with the downwardly depending forehead covering section **13**. Ear-flaps **17** are generally provided and firmly secured to the rigid helmet **11**. The ear flaps are preferably in the nature of flexible and pliable material such as soft rubber, soft plastic, or other suitable forms of fabric to permit ready folding back where desired. Depending from these ear-flap covering sections **17** it is convenient to fasten a suitable chin strap member **19** which fastens below the wearer's chin.

Within the interior of the helmet a plurality of cushioning components **21** in the form of spongy, soft or rigid and resilient material are provided both for locating the unit to the head of the wearer and resiliently cushioning and spacing it from the head of the wearer. About the lower periphery of the helmet and extending completely around the structure from the front region **13** to the rear region **15** and over the recessed ear region there is an internal head-band **23** of desired cross section firmly attached to the helmet inner wall. The head-band **23** is made as a hollow, tubular or rectangular member. This band forms a barrier region between the interior of the helmet and the outside. It is formed of a pliable and resilient composition and is capable of being inflated to desired pressure through one or more entry ports **27** which communicate with a reservoir region **29** supplied as a generally bulbous-shaped component rigidly secured to the helmet wall. The attachment of the reservoir region is preferably at the rear so that when held to the helmet in leak-proof fashion there is an air-tight fit between the outer helmet wall **11** and the reservoir wall **31**. With this arrangement prior to sealing the tubular head-band **23** internally of the helmet and connecting the reservoir thereto through the entry port **27**, the combination of the two elements is inflated (by any desired means, not shown) to a relatively low pressure above atmospheric so that when the wearer covers the head with the helmet, the flexible head-band will fit generally close to the skull and will apply against the skull a pressure of relatively minor value above atmospheric. This low pressure is unobjectionable and scarcely noticeable to the wearer.

Illustratively, and to exemplify the nature of the invention, the head-band **23** may be provided as a more or less rectangular shaped component which has cross-sectional dimensions of about ⅛ inch at its narrow lower and upper regions **33**, which is the region subjected to water pressure from beneath the helmet during submersion and it may have a dimension illustratively of about ½ inch along its sides **35**. With the peripheral dimension of the average head being about 22 inches, this size tubing can be seen to comprise a volume of approximately 1.37 cubic inches. If now the volume of the reservoir **29** be assumed to be comprised of a region of about 4 x 3 x 0.5 inches it will be seen that the reservoir volume is 6 cubic inches. This would provide a mechanical advantage of approximately 5 to 1 between the reservoir and the tubular element.

Further than this, with the assumed dimensions of the tubular element, the area of the tubular head-band **23** in contact with the wearer's head would be about ½ inch by 22 inches, making a contact area of 11 square inches. The area of contact of the reservoir **29** with the water for the assumed conditions will be 4 x 3 or 12 square inches, making this provide a mechanical advantage of about 1.1 to 1. Lastly, considering the area of the head-band in contact with the water for the assumed dimension of the head-band **23**, water pressure will be effective on a region of approximately ⅛ inch by 22 inches or there will be 2.75 square inches in contact with the water. Compared to the area of the reservoir in contact with the water there will be in this respect a mechanical advantage of about 4.3 to 1.

Consequently, it can be appreciated that the head-band provides a barrier of low pressure between the head of the wearer and the interior of the helmet for that region between the outer hard plastic element **11** and the skull. At the same time, the head-band provides a barrier between the skull and the external water so that if the wearer is to use the helmet and submerge, and it be borne in mind that water exerts approximately 0.45 lb. pressure per square inch against all surfaces for each foot of water depth, the assumed head-band inflated to a value of 1 lb. per square inch pressure against the head is such that if the wearer submerged to a depth of 2 feet, for instance, there would be an additional 0.9 lb. per square inch exerted on the external chamber or reservoir **29** which would be transmitted into the head-band and this would be the same pressure that would be exerted per square inch of head-band from the water itself. Due, however, to the mechanical advantage of the reservoir, it can be appreciated that the head-band will always be exerting more pressure against the head of the wearer than the surrounding water and consequently leakage cannot occur. By the same token, leakage cannot occur when the wearer rises to the surface because the head-band provides a seal between the skull and the rigid plastic which prevents compression of any air in the space between the rigid helmet and the skull of the wearer in the region above the head-band.

For most circumstances the ear-flaps **17** need not be made of a form to keep out the water, although it can be appreciated that by holding them tightly to the wearer by the chin-strap **19** a reasonably satisfactory shielding effect can be achieved. For many conditions, and particularly where the wearer intends to use the cap for diving purposes, it is desirable that the ear-flaps be turned up against the outer surface of the helmet, in which event the chin-strap can be reversed over the top of the helmet to connect to the ear-flaps.

The modification of FIGURES 5 and 6 provides in the head-band **41** a pair of chambers or separated regions **43** and **45**. As was the case with the form in which the invention is illustrated in FIGURES 1–4, the tubular section **43** is arranged to communicate with the reservoir **29** by way of the entry port **27'** and its purpose need not be further explained. Where desired in order to equalize

pressure it is in some cases desirable to permit entry of water to the top section of the head-band which can be assured by way of the entry port **47** leading into the top section of the head-band **45**.

Alternatively, for equalization purposes and in order to insure further comfort of the wearer, the head-band may be provided as shown by FIGURE 7 with a pair of tubular elements **49** and **51** each leading into the reservoir **29** by way of entry ports **52** and **53**.

The showing of FIGURE 8 provides minor modifications, particularly in the provision with the tubular head-band **33** also constituting cushioning elements **57** adapted to relieve the wearer from further pressure of the band. For convenience of illustration, the reservoir of FIGURE 8 is shown in a modified form and illustratively may form a part of the head-band itself, as shown more particularly in FIGURE 9.

In the modification of FIGURE 9 a rigid reservoir chamber **61** is formed into the hard plastic structure and secured thereto in leak-proof fashion at the joint **63**, which is maintained both air-tight and water-tight with respect to the plastic wall **11**. Seated beneath the circumferential reservoir **61** and abutting the interior wall **11** of the helmet there is a flexible diaphragm member **65** having access through the opening **67** of the water. The flexible diaphragm (illustrated in its flexed position by the dotted outline) also seals in air-tight fashion to each of the reservoir region **61** and the hard plastic wall **11** at its peripheral regions so that, despite flexing, water from without the hard plastic shell **11** will not be able to enter into the reservoir **61** but will flex the diaphragm (such as to its dotted outline position) so as to compress air contained in the reservoir.

The tubular member **57** is attached to the outer surface of the reservoir **61** and forms a cushioning element **69** which fits against the skull of the wearer and which is in communicating relationship to the interior of the reservoir by the port **71**. The relationship between the interior of the tubular member **57** and the reservoir **61** is such that increased pressure from water external to the wall **11** acting through the opening **67** will cause pressure to build-up in the reservoir and thereby be transferred to the interior of the tubular head-band **57**. The dotted outline shown at **69'** illustrates the flexure of the resilient tubular head-band **57** so as to adapt itself to use by different wearers and also shows the expansion tendency when the air in reservoir **61** is compressed at greater water depths to move the diaphragm **65** to a flexed position, such as **65'** to reduce the reservoir air volume. In this form of the device it becomes clear (as by FIGURE 8) that various diaphragm elements **65** and water-entry ports **67** may be peripherally spaced about the helmet both for aesthetic reasons and to provide, as well, a more sensitive control of pressure in the tubular head-band **57**.

FIGURE 10 shows a slightly modified arrangement whereby the wearer may adapt the structure of FIGURE 9 to any desired initial inflated pressure or by which the inflated pressure, in use, may be increased or decreased. The reservoir **61** may be connected through a port **73** to a tubular member **75** having therein a spring-pressed valve **77** arranged to seat by means of a closure member **79** upon an opening **81** in a flexible tubular member **83** secured in air-tight position to member **75**. The closure member **79** is pressed against the opening **81** by means of a spring adapted to exert pressure greater than atmospheric pressure thereon. In order to determine the pressure against which water entering the reservoir **61** through the port **67** shall be forced to act, the reservoir may be inflated by mouth-pressure (or otherwise) by the mouthpiece **87** attached to the flexible tube **83**, the applied pressure being sufficient to overcome the pressure of closure of the valve **77**. The pressure on valve **77** must be such that it will cut off air (or fluid) exit from the reservoir. If desired, the pressure within the reservoir may be released at the choice of the user by manually (for instance)

pressing the valve pin **89** at a region of the flexible tubular member adjacent thereto thereby to provide an opening passage to atmospheric conditions from the reservoir **61** through the flexible tube **83** and the mouthpiece **87**.

FIGURE 11 illustrates a slightly further modified arrangement wherein there has been, for instance, a generally rigid metallic band or element **91** sealed within the peripheral region of the helmet at a position substantially adjacent to the sealed head-band tubular member **93**. This head-band element is capable of flexure in a manner similar to that shown by the diaphragm **61** of FIGURE 9. A suitable pressure of the order of 1 lb. per square inch (or slightly more if desired) may be established within the tubular head-band member **93** and then, by pressure exerted from the water upon the exterior side-wall **95** of the helmet adjacent to the element **91** and by arranging the helmet to have some resiliency in the region of the band **91**, and by providing the area of band **91** greater than the underexposed area **97** of band **93**, pressure within the tubular head-band **93** will be increased for different depths of use of the helmet by way of a compression of the air, thereby to maintain the tight seal between the wearer and the water.

It will be apparent that various other modifications of the invention may be made within the spirit and scope of this invention.

Having now described the invention, what is claimed is:

1. A bathing cap comprising a substantially rigid helmet to cover the head of a wearer, a fluid-tight tubular member secured to the interior wall of the helmet in a region substantially adjacent to the open edge thereof, the said tubular member being adapted to serve as a head-band for the wearer, a reservoir connected in sealed fashion to the helmet and adapted to be exposed to external pressure varying from atmospheric to that existing at varying depths beneath the water surface, a connecting passage between the tubular member and the reservoir, the said reservoir and the tubular member being normally adapted to be pressurized at a pressure slightly above atmospheric so that with increasing external pressure the pressure within the internal tubular member due to pressure applied from the reservoir is increased and a leak-proof fit to the wearer's head is maintained.

2. The bathing cap claimed in claim 1 wherein the fluid-tight tubular member is rectangular in cross-section and wherein the longer dimension of the cross-sectional form is secured at one side to the interior of the helmet with the second longer dimension side adapted to form the head-band positioned against the wearer's head.

3. The bathing cap claimed in claim 2 comprising, in addition, cushioning means positioned interiorly of the helmet for resting against the head of the wearer.

4. The bathing cap claimed in claim 1 wherein each of the volume and exposed surface area of the reservoir exceeds volume and exposed areas of the fluid-tight tubular member.

5. The bathing cap claimed in claim 1 comprising, in addition, flexible diaphragm means peripherally spaced adjacent to the fluid-tight member and adapted to be flexed with increasing external pressure so that compression of fluid within the tubular member is varied in proportion to changing external pressure and a tight fit between the helmet and the wearer's head is maintained.

6. The bathing cap claimed in claim 1 comprising, in addition, means to increase and decrease the reservoir pressure independently of the operating depth.

7. The bathing cap claimed in claim 6 wherein the means to increase the pressure within the reservoir is provided by a tubular member adapted to connect to an external source of fluid pressure and a normally closed valve means adapted to open under inlet pressure to permit passage into the reservoir at times when external fluid pressure exceeds that of the reservoir and adapted

at other times to remain closed, and means to relieve reservoir pressure independently of external pressure.

8. A bathing cap comprising a substantially rigid helmet for covering the head of a wearer, a fluid-tight tubular member forming a wearer's head-band secured to the interior wall of the helmet in a region substantially adjacent to the open edge thereof, a fluid-tight reservoir of outer area and internal volume greater than that of the tubular member sealed to the helmet outer wall and adapted to be exposed to external pressures varying from atmospheric to those existing at varying depths beneath the water surface, a connecting passage between the reservoir and the tubular member to maintain equalized pressure in each, the said reservoir and the tubular member being adapted to be pressurized when exposed to atmospheric pressure to a pressure slightly above such pressure so that with increasing external pressure effective on the reservoir the applied internal tubular pressure is increased to a value greater than that of the inwardly-pressing water.

9. The bathing cap claimed in claim 8 wherein the fluid-tight reservoir is secured to the outer surface of the helmet.

10. The bathing cap claimed in claim 8 comprising, in addition, a plurality of spaced cushioning means positioned interiorly of the helmet for resting against the head of the wearer.

References Cited in the file of this patent

UNITED STATES PATENTS

1,349,206	Jeffers	Aug. 10, 1920
2,072,483	Naundorf	Mar. 2, 1937