

[54] HEADGEAR WITH AUTOMATIC SIZING MEANS

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[51] Int. Cl. A42b 3/02

[58] Field of Search 2/3 R, 3 A, 3 B, 3 C, 4,
2/5, 6, 68, DIG. 3; 267/117, 118, 65 D;
273/65 C, 65 D

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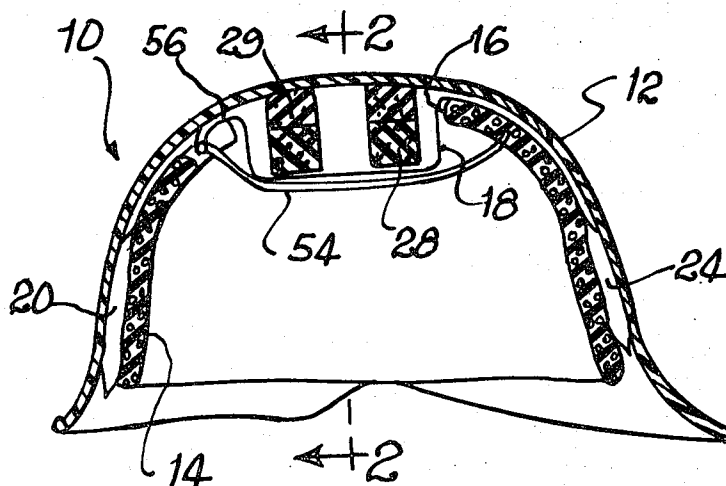
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Primary Examiner—Werner H. Schroeder
Attorney, Agent, or Firm—McDougall, Hersh & Scott

[57] ABSTRACT

This invention relates to a headgear construction comprising a shell having fitting means secured within the shell for engagement with the head of the wearer. The fitting means include at least one chamber connected to a source of compressible fluid. Upon placement of the headgear on the head, the source of fluid is engaged by the wearer's head to displace fluid from the reservoir into the chamber. At the same time, means automatically restrict the flow of fluid from the chamber back to the source whereby there is a variation in the dimensions of the head receiving space of the headgear. The wearer can, thus, force a variation in the head receiving space until a comfortable fit is achieved, and then release pressure whereby the size achieved will be automatically retained until the headgear is removed.

28 Claims, 33 Drawing Figures



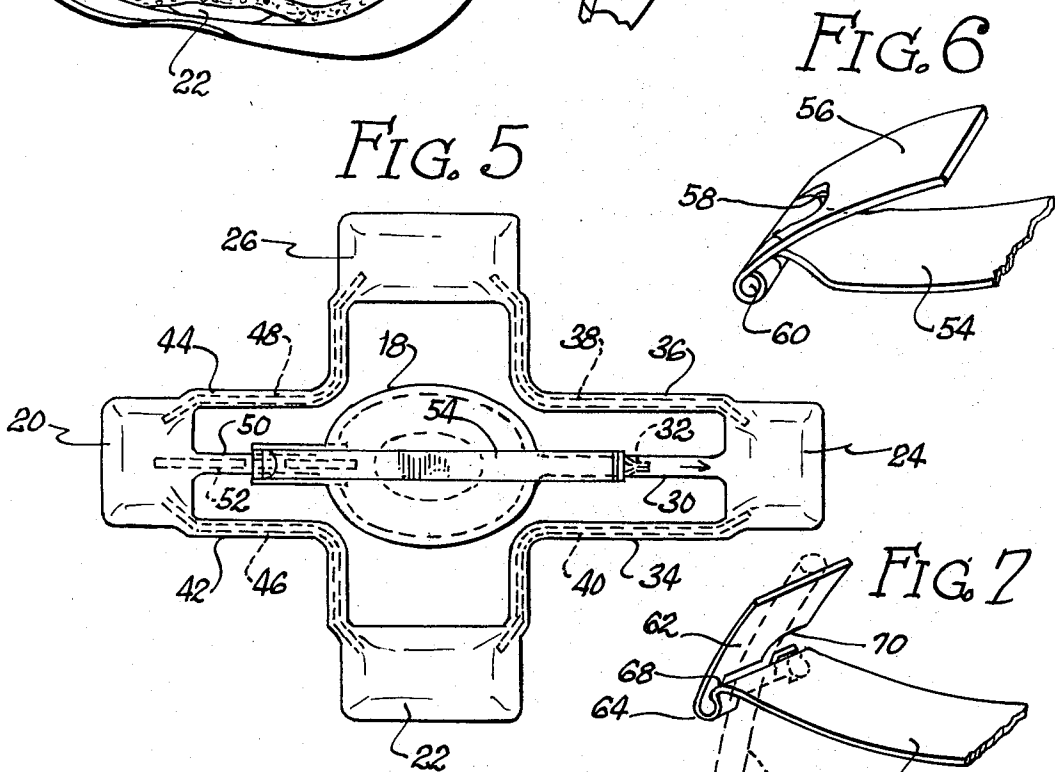
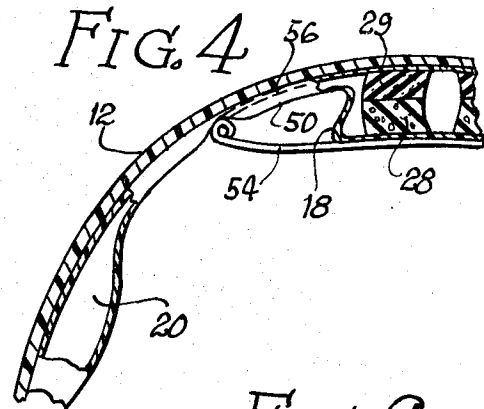
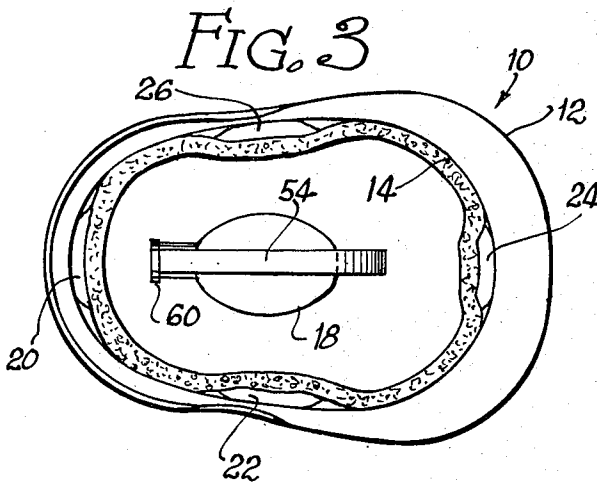
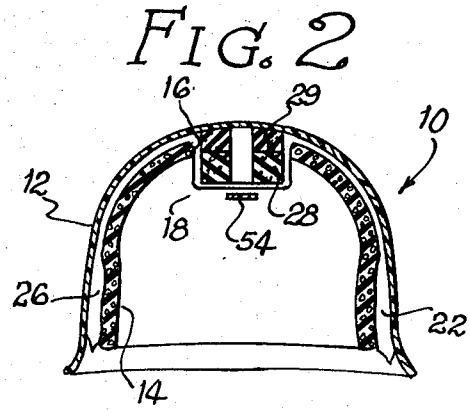
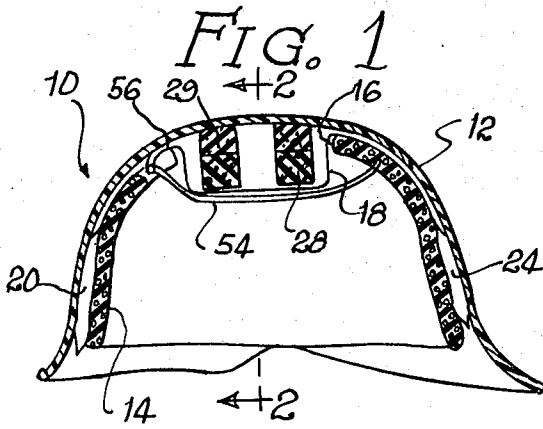


FIG. 8

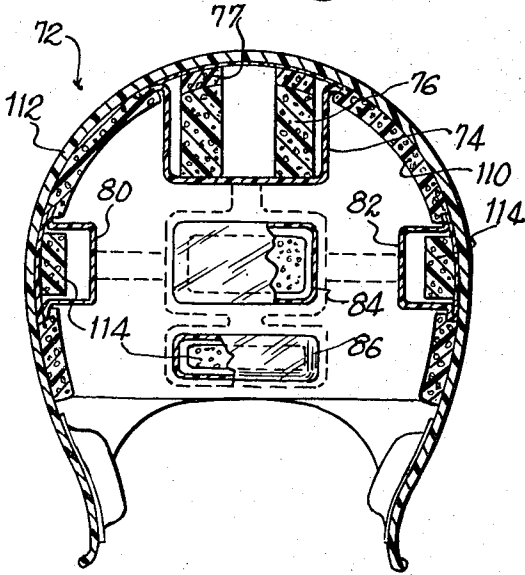


FIG. 9

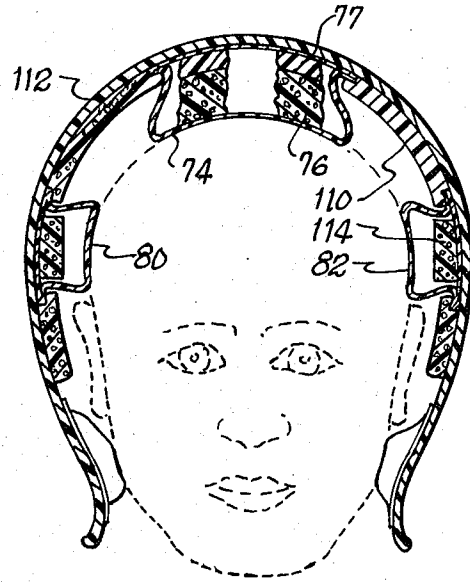


FIG. 10

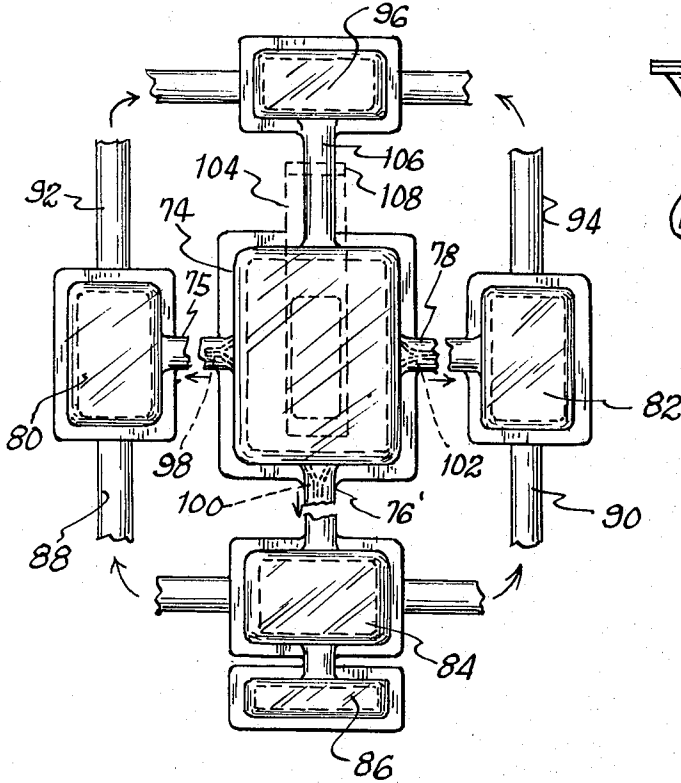


FIG. 11

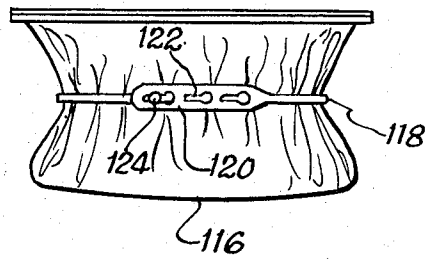


FIG. 12

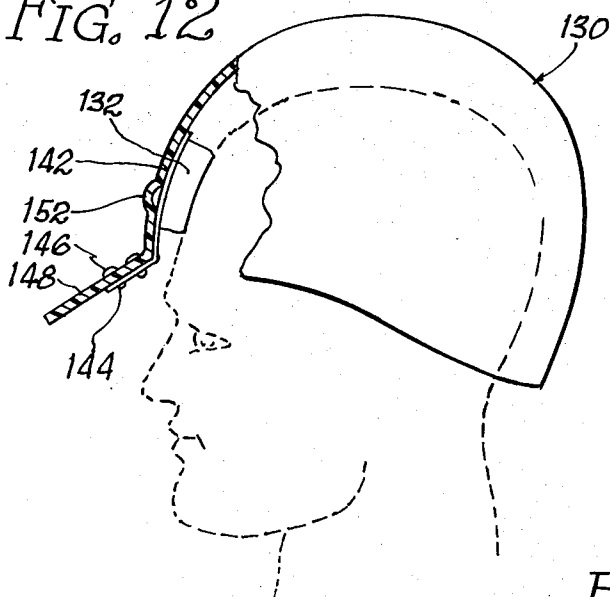


FIG. 13

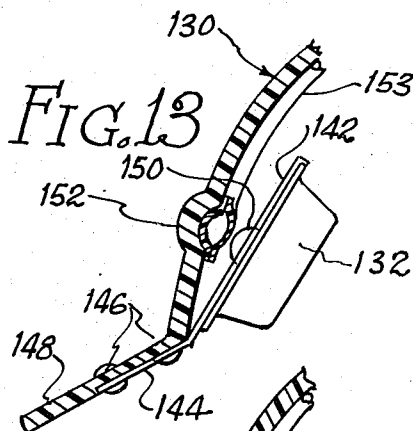


FIG. 14

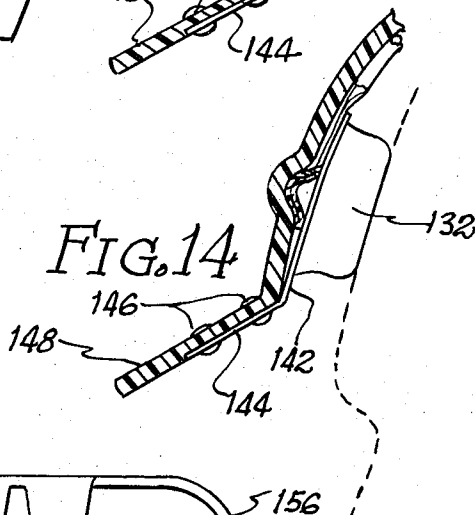


FIG. 15

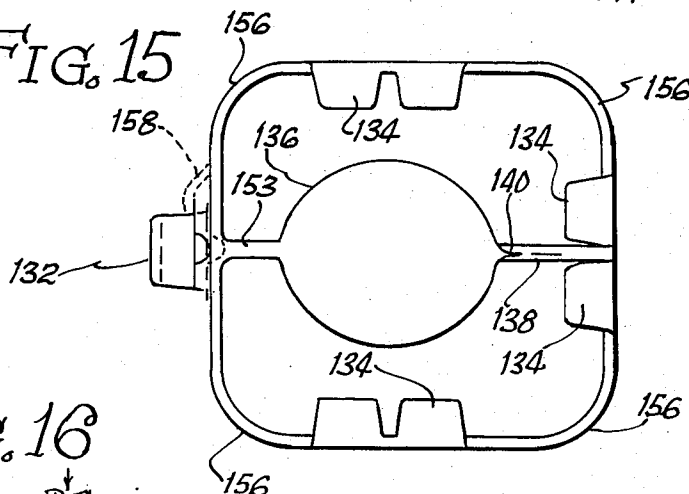


FIG. 16

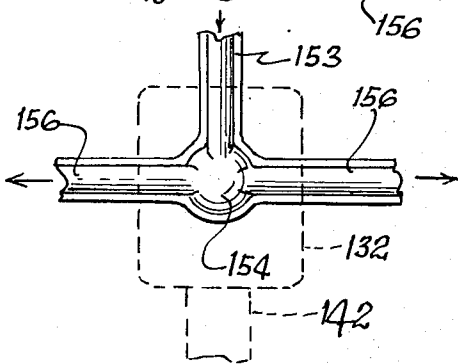


FIG. 17

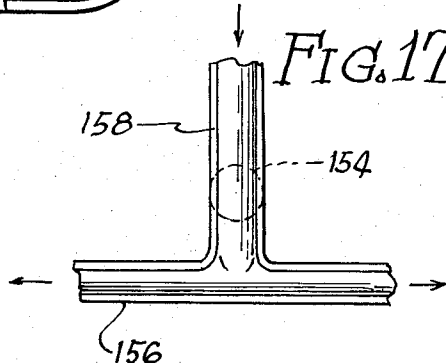


FIG. 18

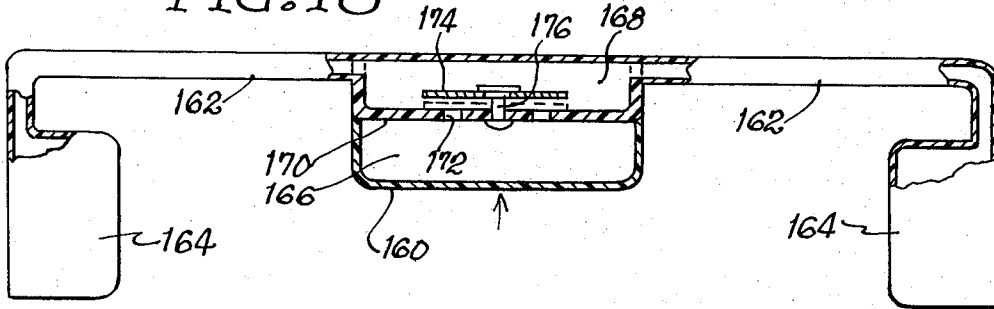


FIG. 19

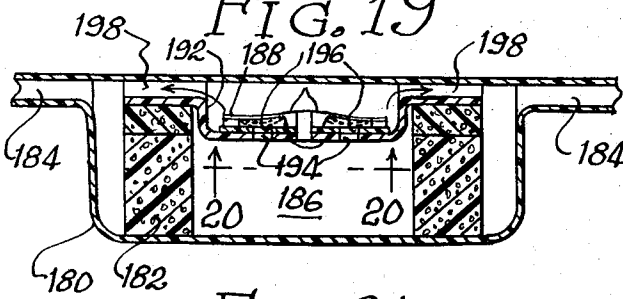


FIG. 20

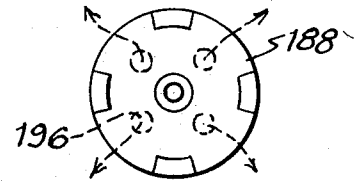


FIG. 21

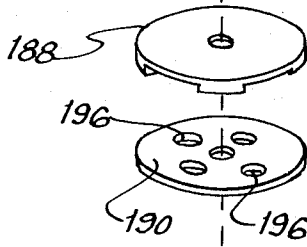


FIG. 22

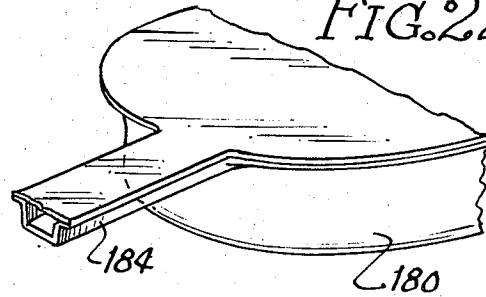
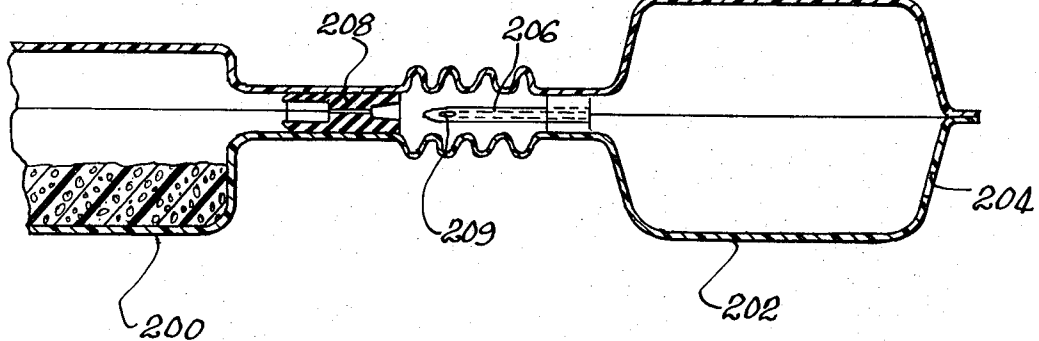


FIG. 23



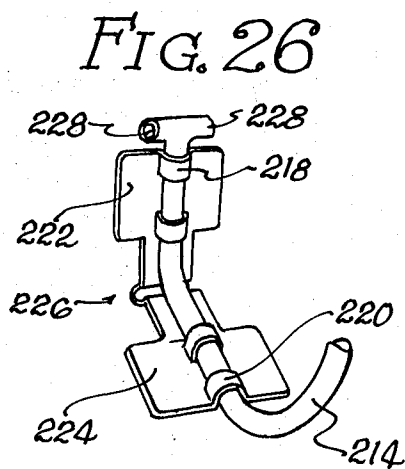
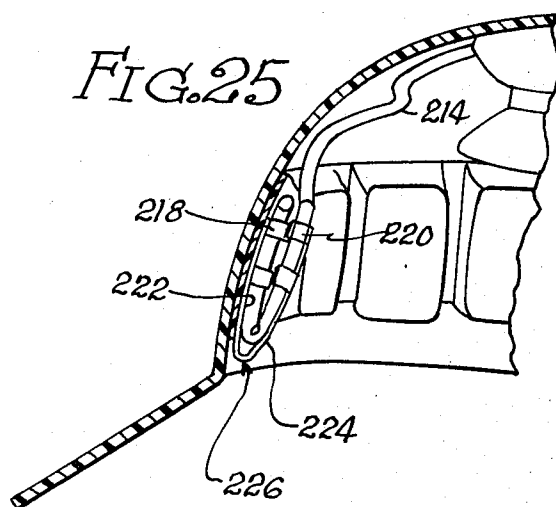
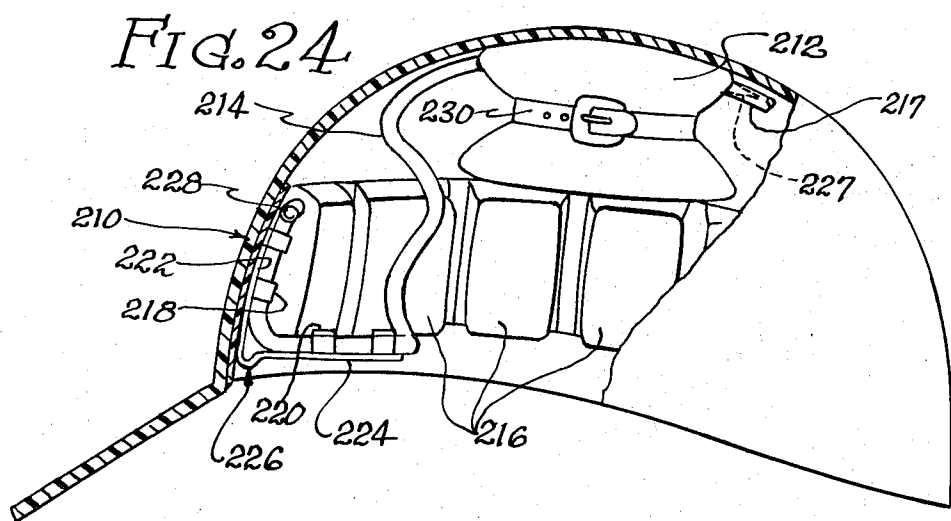


FIG. 27

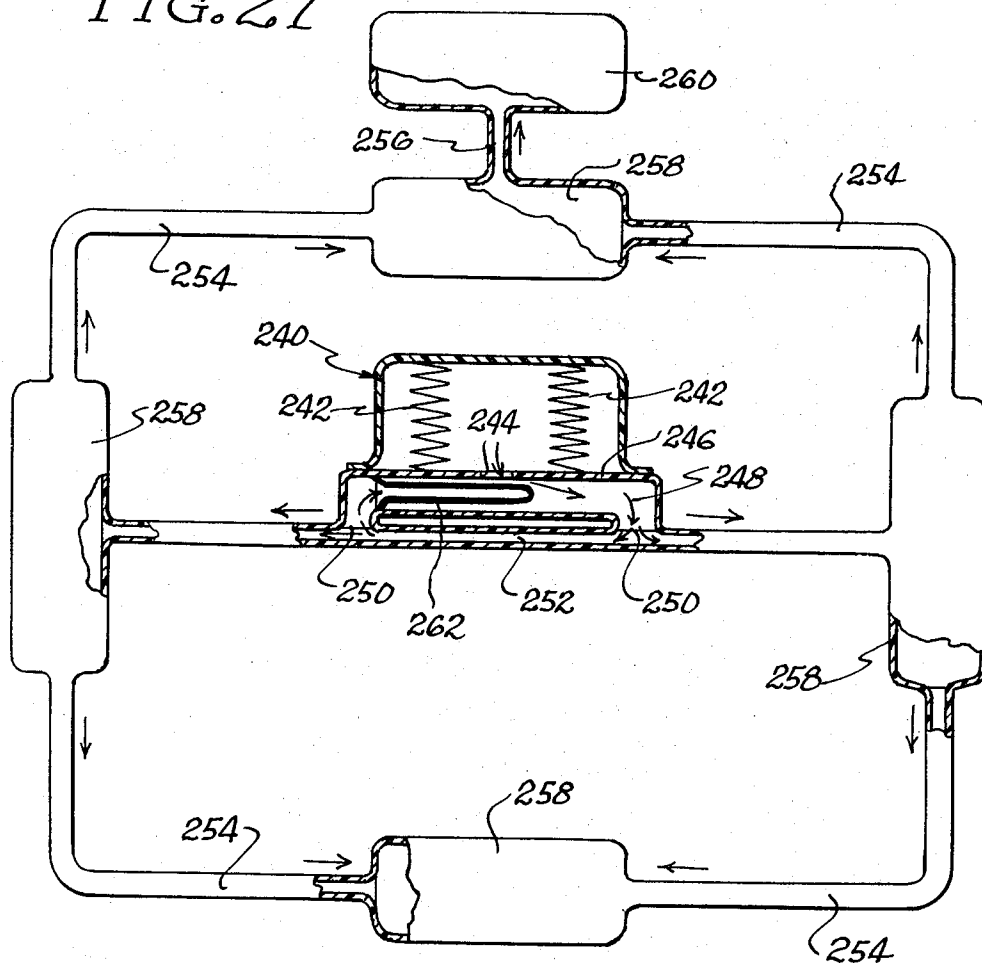


FIG. 28

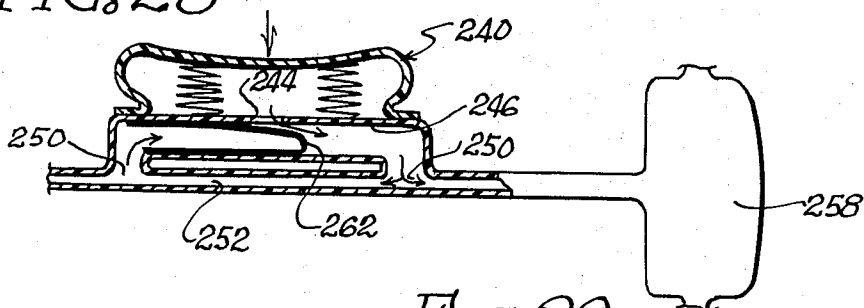
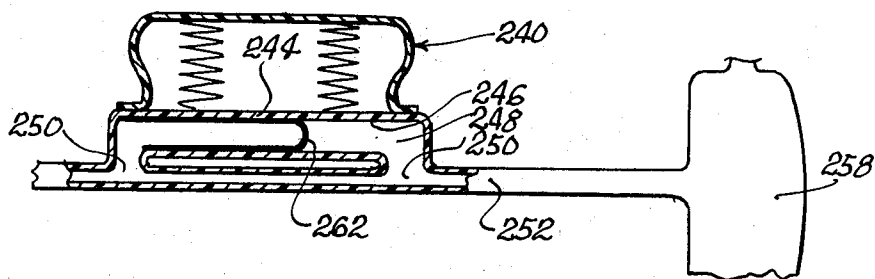
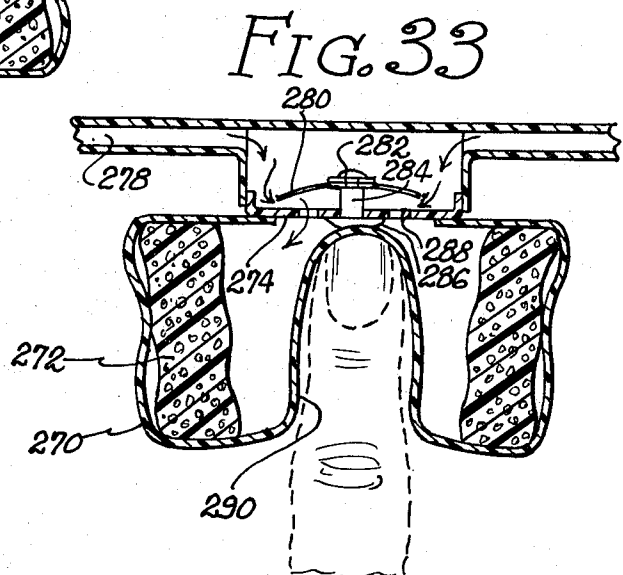
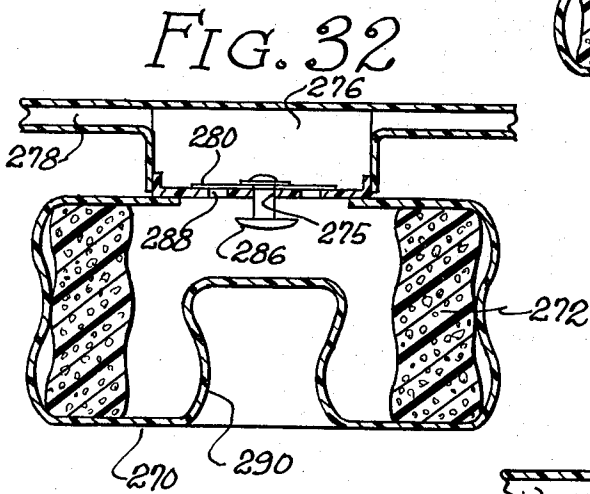
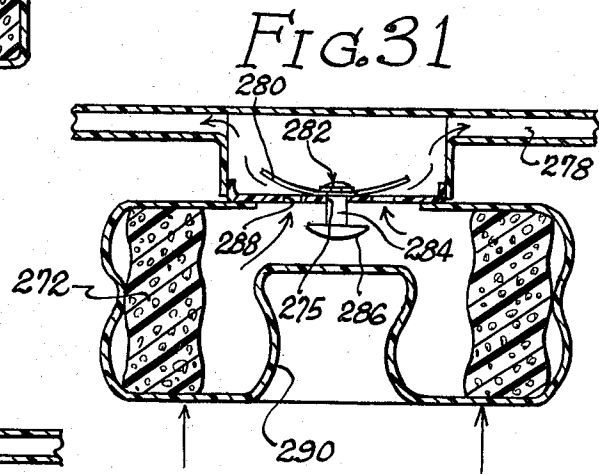
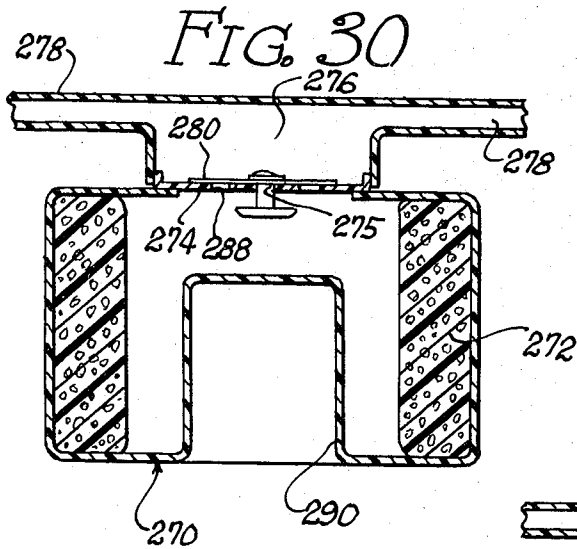


FIG. 29





HEADGEAR WITH AUTOMATIC SIZING MEANS

This invention relates to a headgear construction. Although the invention is applicable to various types of headgear, it finds particular utility in the case of protective type headgear having a relatively hard outer shell construction. In such headgear, means are typically provided within the shell to absorb the forces of impact whereby the wearer of the headgear will be protected against such impact.

In headgear of the type described, problems arise from the standpoint of achieving a suitable fit. Various fitting means, for example strap-type suspensions, have been devised, however, these are not particularly comfortable, and they are very inconvenient when the headgear is to be worn by different individuals. In addition, the assembly of such suspensions with the outer shell is often costly, and the cost of suitable sizing structures is also often high.

In order to provide less expensive protective headgear, sacrifices are often made from the standpoint of fitting of the headgear and also from the standpoint of protection. For example, hard hats used in construction and military headgear are preferably produced on a high production-low cost basis, and the comfort and protective ability of such headgear is often minimal. Batting helmets represent another category of protective headgear which is preferably produced at lower cost. In cases where different individuals are required to use the same helmet, a poor fit is often tolerated in order to save the time required to adjust the helmet size.

It is a general object of this invention to provide a protective headgear construction which includes sizing or fitting means adapted to operate automatically whereby the construction is particularly adaptable for use in headgear intended to be worn by different individuals.

It is a further object of this invention to provide a protective headgear construction which can be produced in a highly efficient manner from relatively uncomplicated components whereby high production at low cost can be achieved.

It is a still further object of this invention to provide a headgear construction of the type referred to in the foregoing objects which also is characterized by completely adequate protection against impact forces while being particularly comfortable for the wearer of the headgear.

These and other objects of this invention will appear hereinafter and for purposes of illustration, but not of limitation, specific embodiments of the invention are shown in the accompanying drawings in which:

FIG. 1 is a cross-sectional view of a headgear construction characterized by the features of this invention;

FIG. 2 is a cross-sectional view of the headgear construction taken about the line 2—2 of FIG. 1;

FIG. 3 is a bottom plan view of the headgear construction;

FIG. 4 is an enlarged fragmentary cross-sectional view illustrating a section of the sizing means employed in the construction;

FIG. 5 is a plan view of a fluid-containing fitting assembly utilized in headgear constructions of the type covered by the invention;

FIG. 6 is a fragmentary perspective view illustrating a fluid shut-off means utilized in the headgear construction;

FIG. 7 is a fragmentary perspective view illustrating an alternative form of fluid shut-off means;

FIG. 8 is a cross-sectional view of a different headgear construction incorporating a sizing means of the type contemplated by the invention;

FIG. 9 is a cross-sectional view illustrating the headgear construction of FIG. 8 as it appears with the head of the wearer within the helmet;

FIG. 10 is a plan view illustrating the modified fluid fitting assembly of the type incorporated in the headgear shown in FIG. 8;

FIG. 11 is an elevational view illustrating a modified form of air supply reservoir for the fluid fitting assembly;

FIG. 12 is a side elevation of a helmet construction incorporating a modified arrangement;

FIG. 13 is an enlarged fragmentary detail view illustrating the arrangement of FIG. 12 with the helmet off;

FIG. 14 is an enlarged fragmentary detail view illustrating the arrangement of FIG. 12 with the helmet on;

FIG. 15 is a diagrammatic illustration of the overall fitting mechanisms employed in the arrangement of FIG. 12;

FIG. 16 is an enlarged fragmentary illustration of the juncture means employed in the arrangement of FIG. 12;

FIG. 17 is a modified form of juncture arrangement;

FIG. 18 is a diagrammatic illustration, partly cut away, of an additional form of fitting means;

FIG. 19 is a cross-sectional view of an alternative form of crown structure incorporating features of the invention;

FIG. 20 is a bottom plan view of the portion of the structure of FIG. 19 taken about the line 20—20 of that figure;

FIG. 21 is an exploded perspective view of the elements shown in FIG. 20;

FIG. 22 is a fragmentary perspective view illustrating the exterior configuration of the structure of FIG. 19;

FIG. 23 is a horizontal sectional view illustrating a form of reservoir inflating and deflating means usable with the constructions of the invention;

FIG. 24 is a side elevation, partly cut away, illustrating a modified form of helmet fitting means shown with the helmet off;

FIG. 25 is a fragmentary cross-sectional view illustrating the fitting arrangement of FIG. 24 shown in the position of use;

FIG. 26 is a perspective view illustrating the particular shut-off arrangement utilized in the construction;

FIG. 27 is a schematic illustration of an additional alternative form of fitting means;

FIG. 28 is a detail view, partly in section, of the crown structure shown in FIG. 27;

FIG. 29 is a detail view, partly in section, illustrating the crown structure of FIG. 28 in the position of use;

FIG. 30 is a vertical cross-sectional view of a still further crown structure arrangement characterized by the features of this arrangement;

FIG. 31 is a cross-sectional view illustrating the crown structure of FIG. 30 during placing of a helmet on the head;

FIG. 32 is a further illustration of the crown structure of FIG. 30 in the position of use; and,

FIG. 33 is a further view of the crown structure of FIG. 30 illustrating the manner of relieving the fitting means for purposes of changing the helmet size.

The headgear construction of the invention comprises an outer portion which will be referred to as the shell and which may be of varying degrees of resiliency including a hard shell which would give only in the case of impact. The invention is particularly concerned with fitting means secured within the shell for engagement with the head of the wearer, the fitting means being automatically operable whereby a proper fit is achieved by the act of placing the headgear on the wearer's head, and pulling down to move air from a main reservoir to peripheral air pillows.

The particular fitting means of the invention comprise at least one chamber connected to a source of compressible fluid. Valve means or the like are provided for permitting passage of fluid from the source to the chamber. Means are also provided for enabling passage of fluid from the chamber to the source.

The structure of the invention operates upon placement of a headgear on the head of the wearer. Force is thereby applied to the source of fluid whereby the fluid will flow into the chamber thereby expanding the chamber and varying the dimensions of the head receiving space within the helmet. The force is applied by the wearer until a comfortable fit is achieved. During this time, shut-off means automatically operate to prevent any substantial return of fluid from the chamber to the source. These shut-off means continue operation when the force being applied by the wearer is relieved. Accordingly, the fit which is achieved by the wearer will be maintained.

Upon removal of the headgear, the shut-off means automatically becomes inoperative whereby the fluid will flow from the chamber back to the source. Accordingly, the headgear is returned to its initial condition whereby another wearer can use the headgear and fit it to his particular needs.

FIGS. 1 through 6 illustrates one form of the invention. In this embodiment, the headgear 10 includes a hard outer shell 12. The shell takes the form of a hard hat, or a football, hockey or batting helmet. In the latter case, a protective ear flap would probably be incorporated with the helmet.

The helmet includes an inner liner 14 formed of a foam plastic, this inner liner being engageable by the head of the wearer of the helmet. The liner defines an opening 16 in the crown area of the helmet, and this opening is provided for receiving a downwardly extending compressible fluid reservoir 18.

As best shown in FIG. 5, the reservoir 18 comprises part of an assembly which also includes fluid receiving chambers 20, 22, 24 and 26. The reservoir 18 and the chambers may be formed from plastic sheet material and then heat sealed whereby air contained within the assembly will be permanently confined. In the case of the chamber 18, a tubular plastic member is provided with a section 28 of soft foam for returning the chambers to shape after removal from the head. An impact absorbing section 29 comprises a stiffer material. Such members could also be incorporated within the chambers connected to the reservoir where practical.

A first conduit 30 extends from the reservoir 18 to chamber 24. This conduit is provided with a one-way valve 32 whereby fluid can be moved through the conduit 30 toward the chamber 24; however, the valve pre-

vents movement from the chamber 24 back to the reservoir. Various valve structures could be employed, and reference is made to Voller U.S. Pat. No. 3,332,420, for an example of a one-way valve structure which can be incorporated into structures formed from plastic sheets.

A pair of conduits 34 and 36 extend from the chamber 24 to the chambers 22 and 26, respectively. These conduits are provided for passing fluid delivered from the reservoir 18 to the chambers 22 and 26. If desired, small diameter plastic tubes 38 and 40 may be disposed within these conduits. These tubes may be of a somewhat stiffer material whereby an open passage between the chambers can be assured.

Additional conduits 42 and 44, provided respectively with plastic tubes 46 and 48, extend from the chambers 22 and 26 to the chamber 20. With this arrangement, air passing from the reservoir 18 will enter each of the four chambers. The chambers 22 and 26 are located at the sides of the helmet while the chambers 24 and 20 are located at the front and rear of the helmet, respectively. It will be appreciated that additional chambers could be included where added protection against impact or different fitting characteristics were desired. Furthermore, the invention contemplates fewer chambers including a single chamber which could extend around all or a portion of the inner surfaces of the helmet shell.

An additional conduit 50 carrying tubular element 52 extends between the chamber 20 and the reservoir 18. Shut-off means including an elongated arm 54 which extends over the outer end of the chamber 18 are associated with the conduit 50. In the embodiment shown in FIG. 6, the arm 54 is hinged to a shorter arm 56. The arm 56 defines an opening 58 in the area of the hinge 60 whereby the conduit 50 can be received in the opening. As best shown in FIG. 1, the shorter arm 56 is positioned adjacent the inside wall of the helmet shell 12.

In the operation of the helmet structure described, the user places the helmet on his head and then presses downwardly. The head engages the arm 54 which pivots the arm to press the arm against the conduit 50 which shuts this line off. In the meantime, the pressure forces air out of reservoir 18 through the valve 32 and conduit 30. Because of the interconnection of the chamber 24 with the other chambers, air is distributed into each chamber whereby the chambers expand. This results in the pressing of the liner 14 against the wearer's head while at the same time the helmet shell is lowered relative to the wearer's head. Thus, the reservoir 18 will reduce in size while the chambers increase in size as is illustrated in FIG. 4. Since the combination of arms 54 and 56 pinches the conduit 50, air flow back into the reservoir is substantially prevented.

It will be appreciated that when pressure is released, the condition of the helmet remains stabilized since the arm 54 remains in the position illustrated in FIG. 4. The wearer thus maintains whatever fit he finds to be comfortable during placing of the helmet on the head. If for any reason the wearer feels that the helmet is too tight, it can be lifted momentarily whereby the arm 54 will pivot back in response to the action of resilient member 28 located within the reservoir 18. This will permit air to pass through conduit 50 into the reservoir. If the wearer is merely adjusting the fit, the pressure can then be reapplied to pinch off the conduit. On the other hand, if the wearer intends to take off the helmet, the

air will pass into the reservoir until the helmet reaches the equilibrium position shown in FIGS. 1 and 2. The helmet is, thus, ready for re-fitting to the head of the next wearer.

FIG. 7 illustrates an alternative arrangement for shutting off the air pressure back to the reservoir 18. In this instance, an integral plastic member is provided with an elongated arm 60 and a short arm 62. An opening is provided in the area of the band 64 for receiving the conduit 66. When the arm 60 is pivoted upwardly relative to the arm 62, this results in pinching of the conduit 66 whereby the flow of air or other fluid is prevented. The pinching action is achieved by means of the bent portion 68 pressing against the conduit with the body of the short arm portion 62 serving as a backup. A slot 70 is defined by the short arm 62 to facilitate insertion of the conduit.

FIGS. 8 through 10 illustrate application of the invention to a helmet structure 72 which is of the type worn by football players. In this embodiment of the invention, an air reservoir 74 is positioned at the crown of the helmet. A tubular, soft resilient plastic member 76 is located in the reservoir to maintain the reservoir in the position shown in FIG. 8 when the helmet is not being worn while tubular section 77 is stiffer and performs an impact absorbing function. The reservoir 74 forms part of an assembly shown in FIG. 10. This assembly includes conduits 75, 76' and 78, each of which extends from the reservoir to an associated air chamber. The chambers 80 and 82 are provided for engaging the sides of a wearer's head, and a pair of associated chambers 84 and 86 are provided for engaging upper and lower neck portions of the wearer. Conduits 88, 90, 92 and 94 communicate with the chambers 80 through 86. The latter conduits connect the chambers 80 and 82 to a chamber 96 which is provided for engaging the front of the wearer's head.

One-way valves 98, 100 and 102 are provided within the respective conduits 75, 76 and 78. Accordingly, when the helmet is compressed, the air or other fluid within reservoir 74 is moved outwardly through these valves into the chambers 80, 82 and 84. The chamber 96 is supplied by the chambers 80 and 82. It will be appreciated, particularly when considering FIG. 9, that the construction described functions in essentially the same manner as described with reference to FIGS. 1-6. Thus, the reservoir 74 is compressed in opposition to the resilient member 76 forcing air out of this reservoir into the sizing chambers which tend to expand and which, in this case, conform themselves to the head of the wearer pressing against the head to provide a firm and comfortable fit. A shut-off mechanism in the form of arm 104 is employed for pinching the conduit 106 whereby air forced out of the reservoir 74 will not return to the reservoir while the helmet is being worn. This arm is hinged at 108, and may be one of the structures illustrated in FIGS. 6 and 7.

In the embodiment of FIGS. 8 through 10, a resilient impact foam liner 10 is provided for the interior surface of the helmet shell 112. This liner is provided with openings for receiving the reservoir 74 and the interconnected chambers. The chambers will provide a substantial degree of protection; however, the liner provides added protection in the event that the chambers should be completely compressed. Additional resilient pads 114 may be located within the chambers to fur-

ther increase the protection afforded by the construction.

FIG. 11 illustrates a modified version of an air reservoir. In this instance, the reservoir 116 is provided with an encircling band 118 which includes an end portion 120 defining openings 122. The end 124 of the band includes an enlarged head portion adapted to be received and held within one of the openings 122. It will be appreciated that connecting of the band at one or the other of the openings will change the volume within the reservoir. This arrangement may be particularly desirable when the helmets are to be used at various altitudes. In this connection, altimeter readings could be printed adjacent the openings 122 so that the user could adjust the band 118, depending upon the altitude conditions of helmet use.

In the embodiment of the invention shown in FIGS. 12-17, a helmet 130 incorporates a sizing arrangement which includes a front chamber 132 for engaging the forehead of the wearer and also side and rear chambers 134. A main reservoir 136 is positioned in the top of the helmet, and the reservoir is pressed in the manner previously described. Air is adapted to pass through conduit 138 in the direction of the rear chambers 134. A one-way valve 140 is located in conduit 138 and this valve is of the type shown in FIG. 10 whereby air is adapted to enter the rear chambers 134 but cannot return.

The chamber 132 is supported on a stiff member 142 which defines an end portion 144 secured by rivets 146 to the beak 148 of the helmet. The member 142 defines a bead 150 which is adapted to be received by an indented portion 152 of the helmet shell. Conduit 153 extends from the reservoir 136 and terminates, as best shown in FIG. 16, in a juncture 154 which is located immediately opposite the position of the bead 150 on the member 142. The conduits 156 extend outwardly from this juncture for the passage of air through conduits 156 from the chambers 134.

In the operation of this structure, the pressure in chambers 132, 134 and 136 is substantially equalized when the helmet 130 is not in use. Upon placement of the helmet on the head, the reservoir 136 will be compressed whereby air will pass through conduit 138 into the lines 156. This supply of air will cause the chambers 134 to expand until the helmet is properly fit. The bead 150 will press against the juncture 154 as shown in FIG. 14 thereby closing off communication between the lines 153 and 156 to prevent return flow to reservoir 136 until the helmet is removed from the head.

In the structure described, an additional line 158 may be provided for passing air from line 156 into chamber 132 whereby this chamber will also expand during placement of the helmet on the head. In the arrangement of FIG. 17, the bead 150 is located for direct engagement with line 153 rather than at a juncture between this line and the line 156. This arrangement will also prevent passage of air through the line 153 during helmet fitting.

In the structure shown in FIG. 18, a crown reservoir 160 communicates through lines 162 with fitting chambers 164. The latter may be located in any desired position, for example, if the system is to be used in a helmet whereby side, front and back chambers would be employed.

The reservoir 160 includes an outer air chamber 166, and an inner air chamber 168 with the lines 162 open-

ing into this inner chamber. An intermediate wall 170 divides the respective chambers, and openings 172 in this wall provide communication between the chambers.

A plate 174 is mounted on a rivet 176 which is received by an opening in the wall 170 with the length of the rivet permitting reciprocation of the plate relative to the wall. When the system illustrated is utilized in a helmet, pressure is applied to the chamber 166 which forces the plate 174 away from the openings 172 whereby air is forced through lines 162 into chambers 164. By maintaining this pressure, the wearer of the helmet can achieve a comfortable fit. As soon as the wearer relieves manual pressure on the helmet, there will be a tendency for the chamber 166 to expand whereby the resulting tendency toward a pressure differential will immediately close the plate 174 thereby maintaining the comfortable fit for the wearer.

In the structure shown in FIGS. 19-22, a crown reservoir 180 contains a tubular foam structure 182 which normally maintains the reservoir in an expanded state. Lines 184 communicate the reservoir with any desired number of fitting chambers. Air in the reservoir chamber 186 is adapted to pass into these lines, and in this connection, the tubular structure 182 serves as a seal whereby air in the chamber 186 will not move outwardly through this tubular member.

A valve structure comprising a leaf valve 188 and a stiff apertured disc 190 are supported within the structure by means of a plastic sheet member 192. This sheet member defines openings 194 which align with the apertures 196 of the disc 190.

In the operation of the structure of FIGS. 19-22, the tubular member 182 will be compressed upon the application of force which is manually applied as when placing a helmet on the head. This action will force air from the chamber 186 through the openings 194 and 196. The leaf valve 188 permits this passage of air as long as there is continued application of pressure. The air passes through channels 198 which communicate with the lines 184. As soon as the pressure on the chamber 186 is relieved, as when the user removes his hands from the helmet shell, the tendency of the chamber 186 to expand causes the leaf valve 188 to move downwardly into the dotted line position shown thereby closing off the openings 196.

FIG. 23 illustrates one means for introducing air to a reservoir 200, this reservoir being any of the types described herein. Throughout the life of a structure of the type described, air may be lost which will require replenishing of the air. In addition, it may be necessary to change the amount of air within a system, for example when different altitudes are encountered. The structure of FIG. 23 includes a bulb 202 which is adapted to be manually depressed whereby air entering the bulb through port 204 will be forced through needle 206. This needle is adapted to be forced through valve 208 whereby the opening 210 in the end of the valve will supply air to the interior of the reservoir 200. In addition, the mere insertion of the needle valve without the application of pressure to the bulb 202 will provide for the removal of air where a decrease in the amount of air is desired.

The arrangement of FIG. 24 comprises a helmet 210 which is provided with an air reservoir 212 having a conduit 217 extending therefrom for passing air to the interconnected chambers 216. These chambers prefer-

ably extend all around the interior of the helmet for protecting the front, back and sides of the wearer's head.

Extending from the chambers 216 and back to the reservoir 212 is a conduit 214. The conduit 214 is received within bands 218 and 220 which are formed on the sections 222 and 224 of hinged member 226. The conduit 214 may be provided with double outlet openings 228 for the distribution of air in both directions.

The section 222 of the hinged member 226 is secured to the front wall of the helmet, and the section 224 is movable away from this front wall. When the helmet is not in use, this section is located in the position shown in FIG. 24. Upon placement of the helmet on the head, the wearer's head will compress the reservoir 212 thereby forcing air through one way valve 227 in conduit 217 for passage into the chambers 216. At the same time, the wearer's head will bend the section 224 upwardly and this section will pinch the conduit 214 to the extent that passage of air back into reservoir 212 is prevented. The user continues to pull down on the helmet to expand chambers 216 until a comfortable fit is obtained and when pressure by the wearer is released, an equilibrium condition is achieved whereby the fit is maintained until the wearer removes the helmet. The fit, of course, is restored each time the helmet is placed on a wearer's head. As in the case with the various other structures, the automatic fitting is of particular value where the same helmet is to be used by several different persons.

In the structure of FIG. 24, a belt 230 is fit around the reservoir 212 for changing the pressure of the air within the reservoir. This belt and reservoir thus function in the manner of the structure illustrated in FIG. 11.

In the system illustrated in FIGS. 27-29, a central reservoir 240 is normally maintained in an expanded condition by means of springs 242. These springs may comprise a tubular resilient member as illustrated in FIG. 19. At any rate, when the system of FIG. 27 is incorporated in a helmet shell or the like, the reservoir 240 will assume its largest dimension when the helmet is not in use.

An opening 244 is formed in the bottom wall 246 of the reservoir, and this opening communicates with an adjacent chamber 248. The chamber 248 defines two or more openings 250 which communicate with line 252. This line, as well as lines 254 and 256 provide means for transferring air between the reservoir 240 to the fitting chambers 258 and 260. The latter chamber is connected by means of the line 256 to one of the chambers 258, and it will be understood that any number or configuration of such additional chambers may be employed in accordance with the concepts of this invention, depending upon the particular fitting and protection needs involved.

The chamber 248 holds a balloon valve member 262 which may be formed from latex or similar material. In the use of this structure, the placement of a helmet on the head will result in the compression of chamber 240 as shown in FIG. 28, and the balloon valve member 262 will inflate; however, the manual pressure is sufficient to force air from the reservoir 240 into the lines directed to the fitting members 258 and 260 whereby these members will expand to provide the desired fit. A degree of back pressure will develop tending to force the valve member 262 to close off the opening 244, and this back pressure is only overcome by the exertion of

manual force, for example by the wearer pushing downwardly on the helmet.

When the wearer releases the manual pressure, there will be an immediate tendency for the reservoir 240 to expand in which case the back pressure will force the valve member 262 to close off the opening 244 thereby preventing the passage of air back into the chamber 240. The fit obtained by the operation will, therefore, be maintained for use of the helmet on a continuing basis.

In the arrangement illustrated in FIGS. 30-33, an air reservoir 270 is normally maintained in an expanded state by means of tubular foam member 272. A wall 274 separates the reservoir from a chamber 276 and lines 278 extend from the chamber for purposes of delivering air to any number of fitting members. A valve structure in the form of leaf spring elements 280 is positioned on the wall 274. These leaf spring members are held in place by means of a rivet 282, this rivet defining a shank 284 which extends through an opening in the valve member and an aligned opening 274. The head 286 of the rivet is normally in spaced relationship relative to this wall.

The valve member is formed of a flexible material, for example, a strip of polyethylene, whereby the application of pressure to the reservoir 270 will force the valve member away from openings 288 which are formed in the wall 274. Air will, therefore, be distributed in the system as long as this manual pressure is applied. When the pressure is relieved, the tendency toward the creation of a vacuum in the chamber 270 provides the necessary back pressure to close the valve member 280 whereby the system will be at equilibrium as shown in FIG. 32.

The reservoir 270 defines an enlarged pocket 290 which is provided for purposes of restoring the system to the condition of FIG. 30, for example if a helmet is to be used by a different individual. As shown in FIG. 33, the restoration is easily accomplished through engagement of the head 286 of the rivet 282 whereby the valve 280 is forced away from the wall 274 so that air will fill the reservoir 270 as the tubular member 272 forces the reservoir to expand.

It will be appreciated that the headgear sizing means described provide distinct advantages with respect to conventional arrangements wherein straps or other adjustable means are provided for varying the fit of a helmet. The structure described can be merely placed on the head of the user, and it will then be automatically held to desired dimensions as long as the user keeps the helmet on his head. The helmet can be designed to rapidly return to an equilibrium position as soon as pressure is relieved or the fit can be maintained. The refitting feature makes the helmet particularly desirable as a battering helmet since such helmets are frequently used by a plurality of individuals. Since the helmet can rapidly be fitted to any individual, problems such as game delays can be eliminated.

By providing a proper fit, the helmet constructions described provide another highly important advantage. Thus, it is known that a properly fit helmet will provide a safer helmet, and this is accomplished in a highly efficient way by means of the structure of this invention. The provision of resilient padding in addition to the sizing means also increases the safety factor of the helmet. All of these advantages are accomplished by means of

the relatively simple structures described whereby low cost production of the helmets is possible.

It will be understood that various changes and modifications may be made in the above described construction which provide the characteristics and advantages of this invention.

What is claimed is:

1. In a headgear construction comprising a shell, and fitting means within the shell for engagement with the head of the wearer, the improvement wherein said fitting means comprises at least one chamber, a source of compressible fluid, means interconnecting said source and said chamber, said interconnecting means including a first means permitting passage of said fluid from said source to said chamber, and a second means permitting passage of said fluid from said chamber to said source, means engageable by the head of the wearer upon placement of the headgear on the head operating to transfer said fluid through said first means from said source to said chamber whereby the dimensions of the head receiving space within the helmet will vary, and means for restricting operation of said second means upon placement of the headgear on the head to restrict passage of said fluid back to said source to thereby substantially maintain the variation in size change while the headgear is in place on the head.

2. A construction in accordance with claim 1 wherein said source comprises a flexible reservoir.

3. A construction in accordance with claim 2 wherein said reservoir is located beneath the crown of said shell, and wherein said reservoir is compressed to transfer said fluid out of said reservoir when the reservoir is engaged by the top of the wearer's head.

4. A construction in accordance with claim 3 wherein said chamber engages the sides of the wearer's head, said first means comprising a conduit extending between the reservoir and chamber, and a one-way valve in said conduit permitting flow of fluid only in the direction from the reservoir to the chamber.

5. A construction in accordance with claim 4 wherein said second means comprises a second conduit extending from said chamber to said reservoir, and shut-off means engageable with said second conduit when the headgear is on the head operating to restrict the flow of fluid through said second conduit.

6. A construction in accordance with claim 5 wherein said shut-off means comprises a pivotally mounted arm adapted to be pressed against said conduit.

7. A construction in accordance with claim 3 wherein said fitting means include a plurality of said chambers, said chambers being located in spaced positions relative to the side wall of said shell for engaging the sides of the wearer's head, said first means comprising conduits interconnecting said reservoir and chambers, said conduits including one-way valve means for permitting flow of fluid only in the direction from the reservoir to the chambers.

8. A construction in accordance with claim 7 wherein said second means comprises at least one second conduit extending from said chamber to said reservoir, and shut-off means engageable with said second conduit when the headgear is on the head operating to stop the flow of fluid through said second conduit.

9. A construction in accordance with claim 8 wherein said shut-off means comprises a pivotally mounted arm adapted to be pressed against said conduit.

10. A construction in accordance with claim 7 including resilient padding secured to the inside wall of said shell to provide additional protection for the head of the wearer.

11. A construction in accordance with claim 7 including resilient padding located within said chambers.

12. A construction in accordance with claim 11 including additional resilient padding surrounding said chambers.

13. A construction in accordance with claim 2 including means for adjusting the volume of said reservoir to accommodate different atmospheric pressure conditions.

14. A construction in accordance with claim 6 wherein said arm extends over said reservoir for engagement by the wearer's head, said arm being included in an assembly having a short arm portion pivotally attached to said first mentioned arm, and an opening defined by said assembly receiving said second conduit to pinch the conduit shut upon pivoting of said arm.

15. A construction in accordance with claim 14 wherein said first mentioned arm and said short arm are formed integrally from a flexible plastic material.

16. In a headgear construction comprising a shell, and fitting means within the shell for engagement with the head of the wearer, the improvement wherein said fitting means comprise at least one chamber, a source of compressible fluid, means interconnecting said source and said chamber, said interconnecting means including means permitting passage of said fluid from said source to said chamber and permitting passage of said fluid from said chamber to said source, means engageable by the head of the wearer upon placement of the headgear on the head operating to transfer said fluid through said interconnecting means from said source to said chamber whereby the dimensions of the head receiving space within the helmet will vary, means for restricting passage of said fluid back to said source when said headgear is on the head to thereby substantially maintain the variation in size change while the headgear is in place on the head, and means for automatically transferring said fluid back to said source through said interconnecting means when the headgear is removed from the head.

17. A construction in accordance with claim 16 wherein said source comprises a flexible reservoir.

18. A construction in accordance with claim 17 wherein said reservoir is located beneath the crown of said shell, and wherein said reservoir is compressed to transfer said fluid out of said reservoir when the reservoir is engaged by the top of the wearer's head.

19. A construction in accordance with claim 16 wherein said source comprises a fluid reservoir defining a wall portion, openings defined by said wall portion for the passage of fluid into said interconnecting means, and valve means for closing said openings, said valve means being moved away from said openings upon the application of pressure to said reservoir, and said valve means covering said openings when said pressure is relieved, back pressure in said system holding said valve means against said openings.

20. A construction in accordance with claim 16 wherein said source comprises a reservoir, and including resilient means within said reservoir for normally maintaining the reservoir in an expanded state, said reservoir being engaged by the head of the wearer upon

placement of the headgear on the head to thereby compress said reservoir in opposition to said resilient means.

21. A construction in accordance with claim 20 wherein said reservoir defines an end wall and including openings in the end wall for the passage of fluid from the reservoir to said interconnecting means, the application of pressure to the reservoir forcing fluid through said openings, and valve means associated with said openings, said valve means providing for closing of the openings upon relief of the pressure with the back pressure from said interconnecting means holding the valve means in the closed position.

22. A construction in accordance with claim 21 including means for manually engaging said valve means to force the valve means away from said opening to thereby provide for return of fluid into said reservoir.

23. In a headgear construction comprising a shell, and fitting means within the shell for engagement with the head of the wearer, the improvement wherein said fitting means comprise at least one chamber, a source of compressible fluid, means interconnecting said source and said chamber, said interconnecting means including means permitting passage of said fluid from said source to said chamber and permitting passage of said fluid from said chamber to said source, means engageable by the head of the wearer upon placement of the headgear on the head operating to transfer said fluid through said interconnecting means from said source to said chamber whereby the dimensions of the head receiving space within the helmet will vary, said interconnecting means including a passage engageable with the means supporting said chamber, placement of the headgear on the head and engagement of the head with said chamber causing the means supporting the chamber to close off said passage to thereby provide means for restricting passage of said fluid back to said source when said headgear is on the head and to thereby substantially maintain the variation in size change while the headgear is in place on the head.

24. In a headgear construction comprising a shell, and fitting means within the shell for engagement with the head of the wearer, the improvement wherein said fitting means comprise at least one chamber, a source of compressible fluid, means interconnecting said source and said chamber, said interconnecting means including means permitting passage of said fluid from said source to said chamber and permitting passage of said fluid from said chamber to said source, means engageable by the head of the wearer upon placement of the headgear on the head operating to transfer said fluid through said passage means from said source to said chamber whereby the dimensions of the head receiving space within the helmet will vary, and wherein said interconnecting means comprise a flexible conduit, a hinged member tied to said conduit, said hinged member being secured to the inner wall of said shell whereby the hinged member is engaged by the head of the wearer upon placement of the headgear on the head, engagement of the hinged member resulting in pinching of the conduit to thereby provide means for restricting passage of said fluid back to said source when said headgear is on the head and to thereby substantially maintain the variation in size change while the headgear is in place on the head.

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25. In a headgear construction comprising a shell, and fitting means within the shell for engagement with the head of the wearer, the improvement wherein said fitting means comprise at least one chamber, a source of compressible fluid, means interconnecting said source and said chamber, said interconnecting means including means permitting passage of said fluid from said source to said chamber and permitting passage of said fluid from said chamber to said source, said source comprising a reservoir engageable by the head of the wearer upon placement of the headgear on the head, said reservoir including a wall and an opening defined by said wall for the passage of fluid between said reservoir and said interconnecting means to thereby transfer said fluid from said source to said chamber whereby the dimensions of the head receiving space within the helmet will vary, and a flexible valve means positioned adjacent said opening, said valve means comprising a balloon member having its interior communicating with said interconnecting means whereby application of pressure to said reservoir provides for passage of fluid through said opening into said interconnecting means and into said balloon member relief of said pressure forcing said balloon member into engagement with said opening to provide means for restricting passage of said fluid back to said source when said headgear is on the head to thereby substantially maintain the variation in size change while the headgear is in place on the head.

26. In a headgear construction comprising a shell, and fitting means within the shell for engagement with the head of the wearer, the improvement wherein said fitting means comprise at least one chamber, a source of compressible fluid comprising a flexible reservoir,

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means interconnecting said source and said chamber, said interconnecting means including means permitting passage of said fluid from said source to said chamber and permitting passage of said fluid from said chamber to said source, means engageable by the head of the wearer upon placement of the headgear on the head operating to transfer said fluid through said passage means from said source to said chamber whereby the dimensions of the head receiving space within the helmet will vary, means for restricting passage of said fluid back to said source when said headgear is on the head to thereby substantially maintain the variation in size change while the headgear is in place on the head, and wherein said source and chamber are normally closed whereby the fluid contained is maintained constant, and including means for opening communication with said source and chamber for adding fluid thereto or removing fluid therefrom.

27. A construction in accordance with claim 16 wherein said shell is formed of a substantially inflexible material.

28. A construction in accordance with claim 26 wherein said means for opening communication comprise a valve formed of resilient material whereby the valve opening is normally closed, a needle supported adjacent said valve, said needle being adapted to enter the valve opening and said needle defining a hollow passage and an end opening, and a source of fluid connected to said needle whereby forcing of said needle into the valve opening permits the entry and removal of air through the needle passage.

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