(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 222 029**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of the patent specification: **10.10.90**

(51) Int. Cl.[5]: **A42B 3/00**

(21) Application number: **85114069.9**

(22) Date of filing: **05.11.85**

(54) **Inflatable baffled liner for protective headgear and other protective equipment.**

(43) Date of publication of application:
20.05.87 Bulletin 87/21

(45) Publication of the grant of the patent:
10.10.90 Bulletin 90/41

(84) Designated Contracting States:
BE CH DE FR GB IT LI NL SE

(56) References cited:
JP-A-60 173 107

(73) Proprietor: **MATRIX TECHNOLOGIES CORPORATION, 3965 Research Park Drive, Ann Arbor, Michigan(US)**

(72) Inventor: **Gooding, Elwyn R., 2989 West North Territorial Road, Ann Arbor, Michigan(US)**

(74) Representative: **Patentanwälte Müller-Boré, Deufel, Schön, Hertel, Lewald, Otto, Isartorplatz 6, D-8000 München 2(DE)**

EP 0 222 029 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid (Art. 99(1) European patent convention).

Description

The present invention relates to protective equiment, and, more particularly to liners for protective headgear and other protective equiment, and to inflated liners for head protection, with pre-formed chambers or compartments interconnected by small air passages.

Foam plastic pads of selected densities have been enclosed within the compartments to assist in attenuating the force of an impact to the helmet when worn. In other designs, means to regulate the flow of air between the chambers have been employed, such as, the size of intercommunicating orifice, valves and plastic plugs with filters.

Prior art types of shock-absorbing headgear inflatable liners with multiple compartments have only been partially effective.

The types with layers of resilient foam plastic within the compartments do not distribute the force of an impact to the helmet over a very large area of the head of the wearer. The types with only air within the multiple compartments have of necessity been very thick compartments so as not to "bottom-out", or to be instantaneously compressed completely, to thereby transmit a large portion of the force of the impact to the head wearer. The types of valves or inserts with filters to control the flow of air through the intercommunicating air channels have been quite complicated for manufacture.

The problem underlying the invention is to achieve a good function with less bulk and to facilitate blockage of air transmission through the channel and at the same time to avoid friction between the individual element. The aim is to produce less responsiveness to impact any of the known constructions. This problem surprisingly is solved by a liner for use in a protective helmet and other protective equipment comprising a first fexible plastic panel (32), a second flexible plastic panel (31) fixedly attached to the first plastic panel, the first and second attached panels forming at least two spaced-apart preformed air compartments with an integral preformed intercommunicating air channel therebetween, means (100) for inflating the air compartments (33–37, 40–47) to a similar desired pressure, through the intercommunicating channel (50) associated with one of the flexible panels, said liner comprising a plurality of air compartments (34–37, 40–47) interconnected in pairs (34, 36; 35, 37; 41, 43; 44, 46; 45, 47) which in turn interconnect with a central air compartment (33) provided with a valve (100), all the interconnections being achieved with air channels (50), each air compartment comprising an air chamber formed between a first panel (32) and a second panel (31) (Figs. 14–16) in that a bottom panel (90) of the air compartments (33–37; 40–47) consists of a coated fine weave fabric impervious to air and heat bonded to said plastic panel (32), and that only one resilient bafflement (60) is positioned within the air compartments and in contact with the inner surface of bottom panel (90) and top panel (32) and possesses a predetermined thickness and has an outer surface (61) in thight surface-to-surface contact with inner surface (142) of said plastic panel (32), said bafflement extending over the entire contour of said panel (32) except in the area where a portion of said panel defines an air channel (50) with a corresponding portion of said bottom panel (90), the thickness of said bafflement (60), at the free ends thereof, tapering toward the air channel to provide protrusions (65) in said air channels (50) to respond to the pressure of air flow between the compartments (33–47) due to impact applied to the protective helmet.

Advantageously said first flexible panel of said multiple air compartments is Nylon.

Preferably said second flexible panel of said multiple pre-formed air compartments is flexible polyurethane. It can be PVC, polyvinyl chloride, however as well.

It is particularly good that said single stage bafflement is resilient cross linked polyethylene foam plastic.

Whereas in JP-A 60 173 107 (of applicant) the use of an inner bafflement additioned to an outer bafflement is necessary to provide a satisfactory blockage of air transmission, with the present application there is one only inner bafflement (single stage) instead of said two bafflements. It is surprising that such a single bafflement should be sufficient to achieve the same or similar purpose as the two known resilient bafflements.

Protuberances of the inner bafflement is structured such as to enter more deeply into the communication channel thereby providing a blockage of air transmission through the air channel.

It is surprising that such a construction produces even less responsiveness to impact than any construction of the art. There is no fear anymore that there is too much friction between the known elements.

As the bottom panel used with this invention can consist of a coated fine weave fabric which reduces friction developed between the fabric and the end of the bafflement the responsiveness to impact is improved.

The single stage bafflements regulates the outer flow of air to adjacent pre-formed compartments through interaction of integral protrusions at the entrances of intercommunicating air channels in response to a sudden compression of a compartment.

The novel bafflement means controls air flow in an air compartment of the liner used with protective headgear such as football helmets.

It is another advantage of the invention to provide an improved protective baffled liner for use with various equipment such as hockey equipment, space equipment, body protective pads and other applications.

The unique construction of this invention provides an inflatable liner with a thin profile to attenuate the force of an impact over as large an area as possible and the longest period of time with strength, durability and reliability to a high degree, togther with inexpensiveness of construction.

Other objects, features and advantages of the invention will be readily apparent from the following description taken in conjunction with the accompanying drawings in which like reference numerals are

used to indicate like components in the various views.

Figs. 1–22 for facilitating understanding of the invention refer to JP-A 60 173 107.

FIG. 1 is a top plan of the protective helmet incorporating the liner.

FIG. 2 is a front elevation view of the protective helmet with the chin cup/strap removed.

FIG. 3 is an enlarged cross-sectional view taken along line 3–3 of Fig. 1 illustrating embodiments incorporated in the liner of the invention shown assembled in the protective helmet.

FIG. 4 is an enlarged cross-sectional view taken along line 4–4 of Fig. 1 showing a form of the liner assembled in the protective helmet.

FIG. 5 is a bottom plan of the protective helmet with the liner assembled therein.

FIG. 6 is an enlarged cross-sectional view taken along line 6–6 of Fig. 2 showing sizing cushions and the liner assembled in the protective helmet.

FIG. 7 is a top plan taken along line 7–7 of Fig. 3 of a typical trapazoidal shaped air compartement with co-acting outer and inner bafflements.

FIG. 8 is a cross-sectional view taken along line 8–8 of Fig. 7 showing an air compartement with outer and inner bafflements and their relationship to each other and to the intercommunicating air channels to adjacent air compartments.

FIG. 9 is a cross-sectional view taken along line 9–9 of Fig. 7 showing the relationship of the outer bafflement, convoluted inner bafflement, the preformed air compartment and the bottom panel of the air compartment.

FIG. 10 is a top plan of the multi-air compartments with bafflements and integral intercommunicating air channels of the liner. The liner is shown removed from the helmet shown in Figs. 1–6.

FIG. 11 is a cross-sectional view taken along line 11–11 of Fig. 10 showing the bafflements and inflation valve means.

FIG. 12 is an enlarged partical cross-sectional view of an intercommunicating air channel taken along line 12–12 of Fig. 10.

FIG. 13 is an enlarged partial cross-sectional view of a recess for attachment of a VELCRO disc taken along line 13–13 of Fig. 10.

FIG. 14 is a greatly enlarged partial cross-sectional view taken along the center-line of the intercommunicating air channels 50 of Fig. 11 adjacent air compartments of the liner of the invention showing the "at-rest" relationship of the air compartment bafflements to the intercommunicating air channel.

FIG. 15 is the same cross-sectional view as Fig. 14 showing the relationship of the air compartment bafflements to the intercommunicating air channel when the protective helment is properly fitted to a person's head.

FIG. 16 is the same cross-sectional view as Fig. 15 showing the reationship of the air compartment bafflements to the intercommunicating air channel when the wearer's head decelerates into the liner at the time of an impact.

FIG. 17 is an enlarged cross-sectional view taken along the centerline of a typical air compartment with intercommunicating air channels to adjacent air compartments illustrating modified construction of the co-acting outer and inner bafflements.

FIG. 18 is a plan taken along line 7–7 of Fig. 3 of a typical trapazoidal shaped air compartment with another modified construction of the inner bafflement.

FIG. 19 is a cross-sectional view taken along line 19–19 of Fig. 18.

FIG. 20 is a cross-sectional view taken along line 20–20 of Fig. 18.

FIG. 21 is a fragmentary front elevation view taken along line 21–21 of Fig. 6 of an air compartment as it might be assembled in a helmet illustrating a means for stacking two independent liners.

FIG. 22 is a partial cross-sectional view taken along line 22–22 of Fig. 21 with a second independent liner stacked in front of the liner shwon in Fig. 21. An embodiment of the invention is illustrated in the following Figures 23–27.

FIG. 23 is a top plan taken along line 7–7 of Fig. 3 of a modified typical trapazoidal shaped air compartment with a single stage bafflement.

FIG. 24 is a cross-sectional view taken along line 24–24 of Fig. 23 showing a single stage bafflement and relationship to intercommunicating air channels.

FIG. 25 is a greatly enlarged partial cross-sectional view, similar to Fig. 14, taken along the centerline of the intercommunicating air channels between the adjacent air compartments of the modified liner of the invention showing the "at-rest" relationship of the air compartments with single stage bafflements to the intercommunicating air channel.

FIG. 26 is the same cross-sectional view as Fig. 25, similar to Fig. 15, showing the relationship of the air compartments with modified single stage bafflements to the intercommunicating air channel when the protective helmet is properly fitted to a person's head.

FIG. 27 is the same cross-sectional view as Fig. 26, similar to Fig. 16, showing the relationship of the air compartments with modified single stage bafflements to the intercommunicating air channel when the wearer's head decelerates into the liner at the time of an impact.

Of the Figures, Figures 1–22 illustrate the art, i.e. JP-A 60 173 107.

Referring now to Figs. 1–6, reference numeral 5 indicates generally a football helmet of the type which has a liner. The helmet includes a shell 6 composed of a high impact-resistant plastic resin such as ABS (acrylonitrile-butadine-styrene) or polycarbonate. It has a front edge bumper 14 of a resilient material as synthetic rubber or polyurethane and a neck bumper 15 of similar material secured to the back edge. Ear holes 8 and 9 are provided on the sides of the helmet, a liner inflation valve hole 10 and vertialtion holes 11 are in the crown portion.

To assist in fitting a helmet with the liner sizing cushions 20–26 of a resilient foam plastic are positioned between the inside of the outer shell and the liner. The sizing cushions are attached to the outer shell with releasable fabric fastening strips commercially sold under the trade name VELCRO as disclosed in prior U.S. Patent Nos. 2 717 437, 3 009

235, 3 083 737 and 3 154 837. The sizing cushions 20–26 have recesses to accommodate the VELCRO 18 so that the sizing cushions 20–26 fit in surface-to-surface contact with the inside surface of the outer shell G and the inner liner 30 fits in surface-to-surface contact with the inner surfaces of the sizing cushions 20–26. In a similar way of mounting, a larger sizing cushion 27 is used at the front of the helmet 5 for the forehead area of the wearer and another large sizing cushion 29 is used at the back of the helmet 5 for the occiput of the wearer. The combination of sizing cushions and proper inflation of the liner will provide a very wide range of size and shapes of heads of wearers of the helmet.

Shown in Fig. 7 is a top plan taken along line 7–7 of Fig. 3 at a typical trapazoidal shaped air compartment of the liner generally indicated by reference numeral 30 in Figs. 3 and 10. An air compartment and components, shown in cross-sectional views in Figs. 8 and 9 include a bottom panel 31, a pre-formed top panel 32 with integral formed intercommunicating air channels 50, with an outer baffle-ment 60 and inner baffle-ment 70 positioned between the panels. The top panel 32 and bottom panel 31 are heat bonded together around the perimeter of the pre-formed air compartment in the area generally indicated by the numeral 55 leaving only the intercommunicating air channel 50 areas unbonded. The outer baffle-ment 60 is thermoformed of resilient foam cross-liked polyethylene. It is dimensioned and trimmed so that the outer surface 61 is in surface-to-surface contact with the inner surface 142 of the pre-formed top panel 32 of the air compartment with integral formed small protrusions 65 at the entrances to the corresponding intercommunicating air channels 50. The small protrusions 65 are compressed to the proper thickness during the thermoforming operation and sized to width and length during the trimming operation so that they will match the size of the intercommunicating air channels 50. The inner baffle-ments generally indicated by reference numeral 70 are thermoformed of the same material as the outer baffle-ments 60 and have convolutions which are generally parallel to the contour of the outer baffle-ment. The reference numeral 48 in Figs. 7 and 10 generally indicates the top plan of the apexes of the convolutions of the various inner baffle-ments 70 which apex surfaces are in surface-to-surface contact with the inner surfaces 62 of the outer baffle-ments 60.

Referring now to Figs. 10–13, shown is the liner 30 removed from the helmet 5. The liner 30 consists of a plurality of pre-formed air compartments 33, 34, 35, 36, 37, 40, 41, 42, 43, 44, 45, 46 and 47 with co-acting baffle-ments 60 and 70 and have intercommunicating air channels 50 between the air compartments. At the center of the liner is a hexagon shaped thermoformed air compartment 33 in the top panel 32 and an inflating valve means 100 heat bonded at the center of the bottom panel 31. There are three sets-of-two compartments 34/36, 40/42, 44/46 arranged angulately to three sides of the central hexagon-shaped air compartment 33 and three set-of-two air compartments 35/37, 45/47 arranged angulately in a mirror image to the opposite three sides of the hexagon shaped air compartment 33. The outermost air compartments 36 and 37 have clearance flange areas 56 shown cross hatched are heat bonded as are the areas around all of the air compartments generally indicated by the numeral 55, leaving only the intercommunicating air channels 50 unbonded. The relationship of the baffle-ments to the intercommunicating air channels 50 is the same in all air compartments. The outside perimeter of the liner 30 and the inside perimeter of the ear clearance openings 38 and 39 are heat bonded and steel rule die trimmed to the desired contour. Fig. 11, which is a cross-sectional view of the liner taken along line 11–11 of Fig. 10, shows the relationship of the pre-formed top panel 32 of the air compartments, the outer baffle-ments 60, inner baffle-ments 70, intercommunicating air channels 50, and the bottom panel 31 of the air compartments with integral bonded liner inflation valve means 100 at the center. All air compartments are inflated through the single valve means 100. When assembled in the outer shell 6, the inflation valve means 100 is positioned in the hole 10 in the crown section. This permits the liner 30 to be inflated as desired from the outside of the helmet. A typical intercommunicating air channel 50 is shown in enlarged cross-section in Fig. 12. A typical recess for VELCRO 18 for attaching the liner to the sizing pads or in some instances to the inside surface of the helmet shell 6 is shown in enlarged cross-section in Fig. 13.

The method whereby the outer baffle-ments 60 and inner baffle-ments 70 co-act to control the flow of air through the intercommunicating air channels 50 is more readily understood by the explanations of Figs. 14, 15 and 16 which illustrate the relationship of these components "at-rest," i.e. with the liner partially inflated prior to the helmet being positioned on the wearer's head, when properly inflated and positioned on head, and upon an impact respectively. Referring now to Fig. 14, the greatly enlarged cross-sectional view is taken along the centerline of the intercommunicating air channel 50 between adjacent air compartments of Fig. 11 to illustrate the relationship of the air compartments, the inner baffle-ment 70, and the outer baffle-ment 60 with integral protrusion 65 to the corresponding intercommunicating air channel 50. When properly inflated the air pressure within all of the air compartments will be the same and all of the surfaces will be slightly convex. The outer surface 61 of the outer baffle-ment 60 will be in surface-to-surface contact with the inner surface 142 of the top panel 32 of the air compartment and the surface 63 of the outer baffle-ment 60 will be in surface-to-surface contact with the inner surface 131 of the bottom panel 31 of the air compartment. The protrusions 65 on the outer baffle-ment 60 will be at the entrances of the corresponding intercommunicating air channels 50. The apex surface 48 of the convolutions of the inner baffle-ment 70 will be in surface-to-surface contact with the inner surface 62 of the outer baffle-ment 60 with the apex surfaces 49 of the reverse convolutions in surface-to-surface contact with the inner surface 131 of the bottom panel 31 of the air compartment. The peripheral edge surface 74 of the inner

bafflement 70 will be in surface-to-surface contact with the inner surface 62 of the outer bafflement 60.

With the helmet properly fitted to the head of a wearer as illustrated in Fig. 15, the outside surface of the wearer's head 105 compresses the air compartments so that the top panel 32 of the air compartment and the outer bafflement 60 are now slightly concave. The pressure within all air compartments will be the same with but slight pressure of the protrusion 65 against the end of the intercommunicating air channel 50. The inner bafflement 70 is compressed slightly with the resultant radially outward edgewise movement of the peripheral surface 74 against the inner surface 62 of the sidewall of the outer bafflement 60 whose surface 63 has been pressed more firmly against the inner surface 131 of the bottom panel 31 of the air compartment. As a result, the protrusion 65 of the outer bafflement 60 is pressed more firmly into the end of the intercommunicating air channel 50 thereby creating a greater resistance to the flow of air through the channel at the time of impact to the helmet.

Upon an impact to the outer shell 6 as illustrated in Fig. 16, there will be an additional compression of the sidewalls of the outer bafflement 60, pressing the surface 63 more firmly against the inner surface 131 of the bottom panel 31 of the air compartment. There will be additional compression of the air compartment top panel 32 and both the outer 60 and inner 70 bafflements with resultant outward edgewise movement of the peripheral surface 74 thereby pressing the protrusion 65 more firmly into the end of the intercommunicating air channel 50 thus controlling the rate of flow of air from the air compartment opposite the site of the impact. Inasmuch as all components of the liner are resilient, there will always be a flow of air through the intercommunicating air channels 50 from the air compartments with the greatest internal pressure toward the air compartments with less internal pressure. However, the rate of flow will be regulated by the afore described co-acting bafflements 60 and 70 with integral air channel 50 engaging protrusions 65. Thus the force of an impact is attenuated and distributed over a very large area of the head of the wearer and the time to complete deceleration in the given distance is greatly increased through the embodiments of the co-acting bafflements 60 and 70 within the air compartments and interaction of the protrusions 65 with the corresponding intercommunicating air channels 50.

Illustrated in Fig. 17 are modifications which will enhance the control of the outward flow of air from an air compartment upon impact. The outer bafflement 60 and inner bafflement 70 are pre-molded to more precise configurations and dimensions to effect a more efficient control of the rate of flow of air through the intercommunicating air channel 50. The side walls of the outer bafflement 60 are tapered with the edge portion 66 thinner than the main portion so that it will flex edgewise more easily. The inner bafflement 70 has the outer walls of the convolutions tapered as shown with the peripheral edge portion 74 being thinner than the main portion so as to exert a greater localized edgewise pressure at the end of the intercommunicating air channel 50 when the pre-formed air compartment is compressed toward the outer shell.

Referring now to Figs. 18, 19 and 20, shown is a typical trapazoidal shaped air compartment taken along line 7–7 of Fig. 3 illustrating another set of bafflements that can be used for special applications. This type of bafflement could be used in combination with other bafflements when two liners are arranged in a tier as illustrated in Fig. 22. In some instances it may be desirable to use two liners with air compartments with different outer 60 and inner bafflement 70 configurations to accomplish attenuation of impact forces of various degrees. In some applications it may be desirable to have the bafflements within the pre-formed air compartments of the liner next to the outer shell quite firm to thereby respond to a very high mass–high velocity impact at the onset and have bafflements within the wearer's head somewhat softer to thereby further attenuate and redistribute the force of the impact over a much greater area of the head and in a longer period of time. The two liners could be readily stacked or tiered as illustrated in Figs. 21 and 22 using releasable VELCRO 18. Matching recesses 19 of the type shown in Fig. 13 in accommodate the VELCRO 18 would be provided in the innermost surface of the liner adjacent the shell and on the outermost surface of the inner liner. Whereas Figs. 1–22 illustrated the art, Figs. 23–27 illustrate an embodiment of the invention.

Referring to Figs. 23 and 24, shown is a typical trapazoidal shaped air compartment taken along line 7–7 of Fig. 3 of an alternate construction with a single stage bafflement as used in a liner 30. In the modification as shown in Figs. 23–27, the inner bafflement 70 has been eliminated and the applicant's device functions with the outer bafflement 60 as thereinafter modified. The bottom panel 90 of the air compartment consists of a fine weave fabric which has been coated to be impervious to air and be dielectrically heat bonded to the pre-formed air compartment flexible plastic top panel 32. When the fabric bottom panel 90 is coated it becomes firmer but remains flexible. The modified single stage outer bafflement 60 is the same shape as the pre-formed cavity in top panel 32 is purposely formed slightly oversize except the protrusions 65 which are sized to the dimensions of the corresponding intercommunicating air channels 50. The outer surface 61 of bafflement 60 is therefore in tight surface-to-surface contact with the inner surface 142 of the top panel 32 of the pre-formed air compartment and perimeter surface 63 is in tight surface-to-surface contact to the inner surface 91 of the bottom panel 90. The integral protrusions 65 of bafflement 60 extend slightly into the intercommunicating air channels 50.

The method whereby the single stage bafflement 60 responds to an impact to an air compartment to control the rate of flow of air through the intercommunicating air channel 50 is more readily understood by the explanations of Figs. 25, 26 and 27. Referring to Fig. 25, similar to Fig. 14, the greatly enlarged cross-sectional view is taken along the

centerline of the intercommunicating air channel 50 between adjacent air compartments to illustrate the relationship of the air compartment, the single stage bafflement 60 with integral protrusion 65 to the intercommunicating air channel 50 when the liner is partially inflated prior to the helmet being positioned on the wearer's head. In this "at-rest" state and properly inflated, the surfaces of the top panel 32 of the air compartments and single stage baffflements 60 are slightly convex. The relationship of the surface of the baffflements 60 to the pre-formed air compartments will be as afore described. When positioned on the wearer's head and properly inflated as illustrated in Fig. 26, similar to Fig. 15, the air compartments will be slightly compressed so that the surfaces of the top panel 32 in contact with the wearer's head 105 will be slightly concave. The side walls of bafflement 60 will compress very little so that there be but slight pressure of protrusion 65 into the end of the intercommunicating air channel 50.

As illustrated in Fig. 27, smlilar to Fig. 16, with an impact to the outer shell 6, the head 105 of the wearer compresses the air compartment more. There will be a resultant greater pressure of the protrusion 65 into the end of the intercommunicating air channel 50 due to the edgewise outward movement of the protrusion 65 as the side walls of the single stage bafflement 60 are compressed. Thus the rate of flow of air through the intercommunicating air channel is controlled by the pressure of the integral protrusion 65 into the end of the intercommunicating air channel 50. However, as all of the components are resilient there will always be a flow of air from the air compartment with the greatest pressure to the air compartment with less pressure. After the impact, the air compartment with the single stage bafflement 60 will return to its previous configuration. This construction permits repeated impacts at very short intervals as restitution is almost instantaneous.

The applicant's new and novel invention may be used with an inner bafflement 70 and an outer bafflement 60 which may be used singly or stacked as shown in Figs. 21 and 22. The inner bafflement 70 may be eliiminated and the outer bafflement 60 used by itself as shown and described when referring to Figs. 23–27 of the drawings.

The above described liners by their unique construction lend themselves to be adapted to be used in every conceivable kind of protective headgear and other protective equipment where there is a need for maximum attenuation of the force of an impact utilizing a thin profile, light weight structure.

It may be used with inexpensive resilient foam plastic sizing pads in helmets to reduce the number of different outer shells to fit a greater span of head sizes.

It may be used in body protective pads to reduce bulkiness and weight of solid foam pads and increase protection for the area where used.

While the construction of the liner afore-described has particular application to football helmets, it is by no means limited thereto and helmets and other protective equipment incorporating the claimed design of the liner may be advantageously used in all kinds of activities where it is desirable to prevent injury by an impact.

Claims

1. A liner for use in a protective helmet and other protective equipment comprising a first flexible plastic panel (32), a second flexible plastic panel (31) fixedly attached to the first plastic panel, the first and second attached panels forming at least two spaced-apart preformed air compartments with an integral preformed intercommunicating air channel therebetween, means (100) for inflating the air compartments (33–37, 40–47) to a similar desired pressure, through the intercommunicating channel (50) associated with one of the flexible panels, said liner comprising a plurality of air compartments (34–37, 40–47) interconnected in pairs (34, 36; 35, 37; 41, 43; 44, 46; 45, 47) which in turn interconnect with a central air compartment (33) provided with a valve (l00), all the interconnections being achieved with air channels (50), each air compartment comprising an air chamber formed between a first panel (32) and a second panel (31) (Figs. 14-16), characterized in that a bottom panel (90) of the air compartments (33–37; 40-47) consists of a coated fine weave fabric impervious to air and heat bonded to said plastic panel (32), and that only one resilient bafflement (60) is positioned within the air compartments and in contact with the inner surface of bottom panel (90) and top panel (32) and possesses a predetermined thickness and has an outer surface (61) in tight surface-to-surface contact with inner surface (142) of said plastic panel (32), said bafflement extending over the entire contour of said panel (32) except in the area where a portion of said panel defines an air channel (50) with a corresponding portion of said bottom panel (90), the thickness of said bafflement (60), at the free ends thereof, tapering toward the air channel to provide protrusions (65) in said air channels (50) to respond to the pressure of air flow between the compartments (33–47) due to impact applied to the protective helmet.

2. The liner as defined in claim 1 in which said first flexible panel (32) of said multiple air compartments is Nylon.

3. The lines defined in claim 1 in which said second flexible panel (31) of said multiple pre-formed air compartments is flexible polyurethane.

4. The liner as defined in claim 1 in which said second flexible panel (31) of said multiple pre-formed air compartments is flexible PVC, polyvinyl chloride.

5. The liner as defined in claim 1 in which said single stage bafflement (60) is resilient cross linked polyethylene foam plastic.

Patentansprüche

1. Auskleidung zur Verwendung in einem Schutzhelm oder anderen Schutzvorrichtungen mit einer ersten flexiblen Kunststoff-Füllwand (32), einer zweiten flexiblen Kunststoff-Füllwand (31), die fest an der ersten Kunststoff-Füllwand befestigt ist, wobei die ersten und zweiten aneinander befestigten Wände wengistens zwei unter Abstand angeordne-

te vorgeformte Luftkammern mit einem integralen vorgeformten Lufkanal hierzwischen für die gegenseitige Verbindung bilden, Mittel (100) zum Aufblähen der Luftkammern (33–37, 40–47) auf einen ähnlichen gewünschten Druck, durch den einer der flexiblen Wandungen zugeordneten Verbindungskanal (50), wobei diese Auskleidung eine Vielzahl von Luftkammern (34–37, 40–47) umfaßt, die zu Paaren (34, 36; 35, 37; 41, 43; 44, 46; 45, 47) miteinander verbunden sind, die ihrerseits in gegenseitiger Verbindung mit einer zentralen Luftkammer (33), die mit einem Ventil (100) versehen ist, stehen, wobei sämtliche der Verbindungen mit Luftkanälen (50) erreichbar sind, wobei jede Luftkammer eine eigentliche Luftkammer umfaßt, die zwischen einer ersten Füllwand (32) und einer zweiten Füllwand (31) (Figuren 14–16) geformt ist, dadurch gekennzeichnet, daß eine Bodenwandung (90) der Luftkammern (30–37; 40–47) aus einem mit Überzug versehenen feingewebten Gewebe besteht, das luftundurchlässig ist und unter Wärme gegen diese Kunstoffwandung (32) gebunden bzw. mit dieser verklebt ist und daß nur eine federnde Prallwand-Umlenkausbildung (60) innerhalb der Luftkammern und in Kontakt mit der Innenfläche der Bodenwandung (90) und Kopfwandung (32) positioniert ist und eine vorbestimmte Dicke sowie eine Außenfläche (61) in engem Oberflächen/Oberflächenkontakt mit der Innenfläche (142) dieser Kunststoffplatte (32) besitzt, wobei diese Prallwandumlenkausbildung sich über den gesamten Umriß dieser Wand (32) bis auf den Bereich erstreckt, wo ein Teil dieser Wand einen Luftkanal (50) mit einem entsprechenden Teil dieser Bodenplatte (90) bildet, wobei die Dicke dieser Prallwandumlenkausbildung (60) an deren freien Enden gegen den Luftkanal sich verjüngt, um Vorsprünge (65) in diesen Luftkanälen (50) zu bilden, die dem Druck der Luftströmung zwischen den Kammern (33–47) aufgrund von auf den Schutzhelm ausgeübtem Schlag entspricht.

2. Auskleidung nach Anspruch 1, bei der diese erste flexible Wandung (32) dieser Mehrfachluftkammern aus Nylon besteht.

3. Auskleidung nach Anspruch 1, bei der diese zweite flexible Wandung (31) dieser vorgeformten Mehrfachluftkammern aus flexiblem Polyurethan besteht.

4. Auskleidung nach Anspruch 1, bei der diese zweite flexible Wandung (31) dieser vorgeformten Mehrfachluftkammern aus flexiblem PVC, Polyvinylchlorid, besteht.

5. Auskleidung nach Anspruch 1, be der diese einstufige Prallwand-Umlenkausbildung (60) federnder vernetzter Polyäthylenschaumkunststoff ist.

Revendications

1. Revêtement destiné à être utilisé dans un casque de protection et un autre système de protection comprenant une première coque en matière plastique flexible (32), un seconde coque en matière plastique flexible (31) fixée fermement à la première coque en matière plastique, les première et seconde coques fixées l'une à l'autre délimitant au moins deux compartiments à air préformés et espacés, entre lesquels sont disposés des conduits de passage de l'air préformés d'un seul tenant, établissant des intercommunications des moyens (100) pour gonfler les compartiments à air (33–37, 40–47) à une pression similaire désirée, par l'intermédiaire du conduit d'intercommunication (50) associé à l'une des couques flexibles, ledit revêtement comportant une pluralité de compartiments à air (34–37, 40–47) interconnectés par couples (34, 36; 35, 37; 41, 43; 44, 46; 45, 47), qui à leur tour sont interconnectés à un compartiment à air central (33) pourvu d'une valve (100), toutes les interconnexions étant réalisées par des conduits (50) de passage de l'air, chaque compartiment à air comportant une chambre à air formée entre une première coque (32) et une seconde coque (31) (figures 14–16), caractérisé en ce que la paroi inférieure (90) des compartiments à air (33–37, 40–47) est constituée par un fin tissu ondulé formant revêtement, imperméable à l'air et fixé, moyennant l'application d'une chaleur, à ladite coque plastique (32), et que seule une chicane élastique (60) est disposée à l'intérieur des compartiments à air et en contact avec la surface intérieure du revêtement inférieur (90) et de la coque supérieure (32), possède une épaisseur prédéterminée et comporte une surface extérieure (61) est placée en contact intime avec la surface intérieure (142) de ladite coque plastique (32), ladite chicane s'étendant sur l'ensemble du contour de ladite coque (32), hormis dans la zone où une partie de ladite coque définit avec une partie correspondante dudit revêtement inférieur (30), un conduit (50) de passage de l'air, l'épaisseur de ladite chicane (60) au niveau de ses extrémités libres diminuant en direction du conduit en formant des parties saillantes (65) dans lesdits conduits (50) de passage de l'air de manière à répondre à la pression de l'écoulement d'air entre les compartiments (33–47) sous l'effet d'un choc appliqué au casque de protection.

2. Revêtement selon la revendication 1, dans lequel ladite première coque flexible (32) desdits compartiments à air multiples est formée de Nylon.

3. Revêtement selon la revendication 1, dans lequel ladite seconde coque flexible (31) desdits compartiments à air préformés multiples est formée de polyuréthane flexible.

4. Revêtement selon la revendication 1, dans lequel ladite seconde coque flexible (31) desdits compartiments à air préformés multiples est formée de PVC, chlorure de polyvinyle, flexible.

5. Revêtement selon la revendication 1, dans lequel ladite chicane étagée unique (60) est formée par une mousse de matière plastique élastique formée par du polyéthylène réticulé.

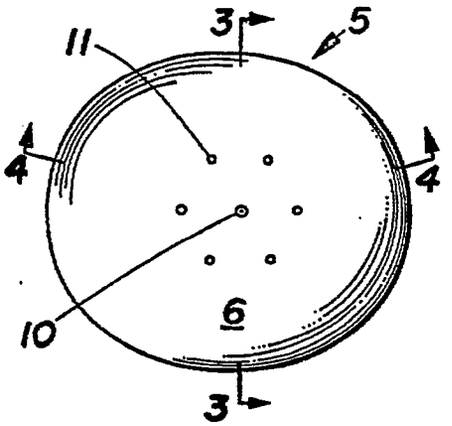


Fig. 1

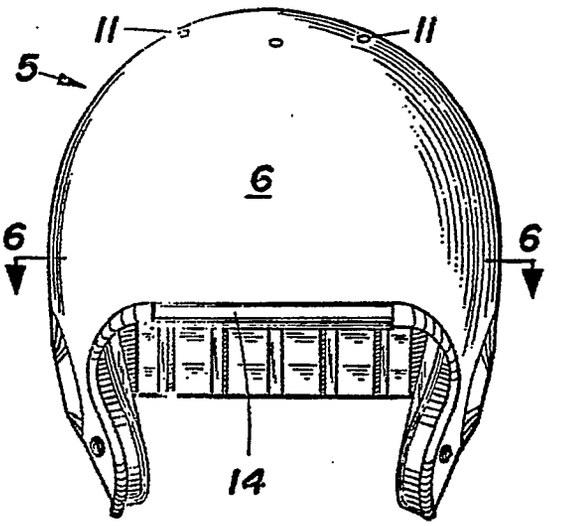


Fig. 2

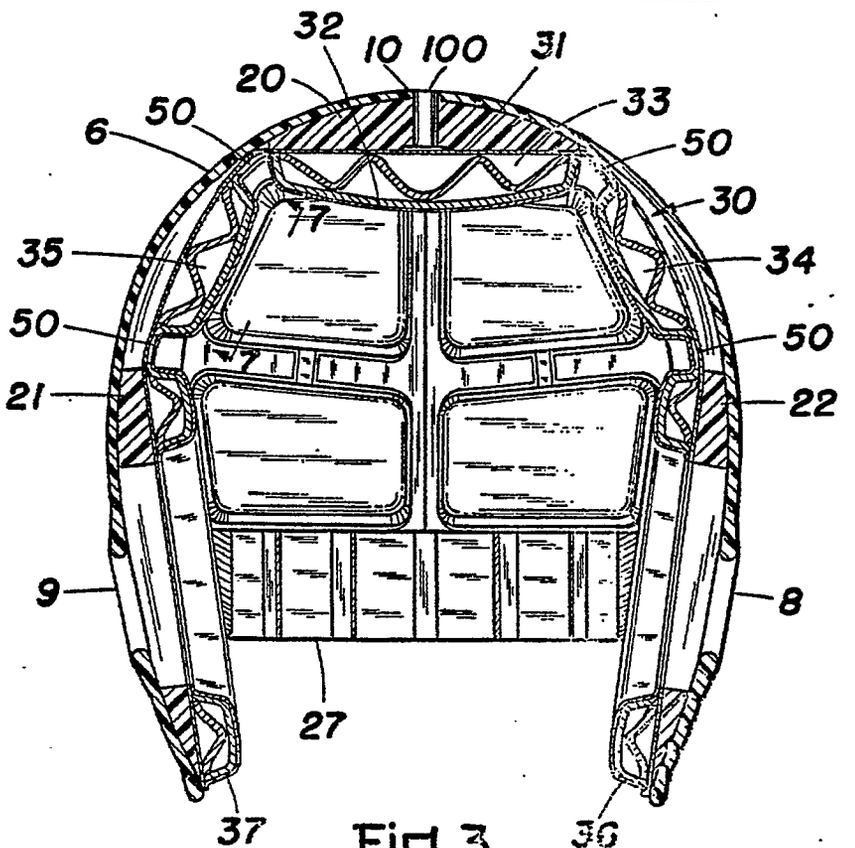


Fig. 3

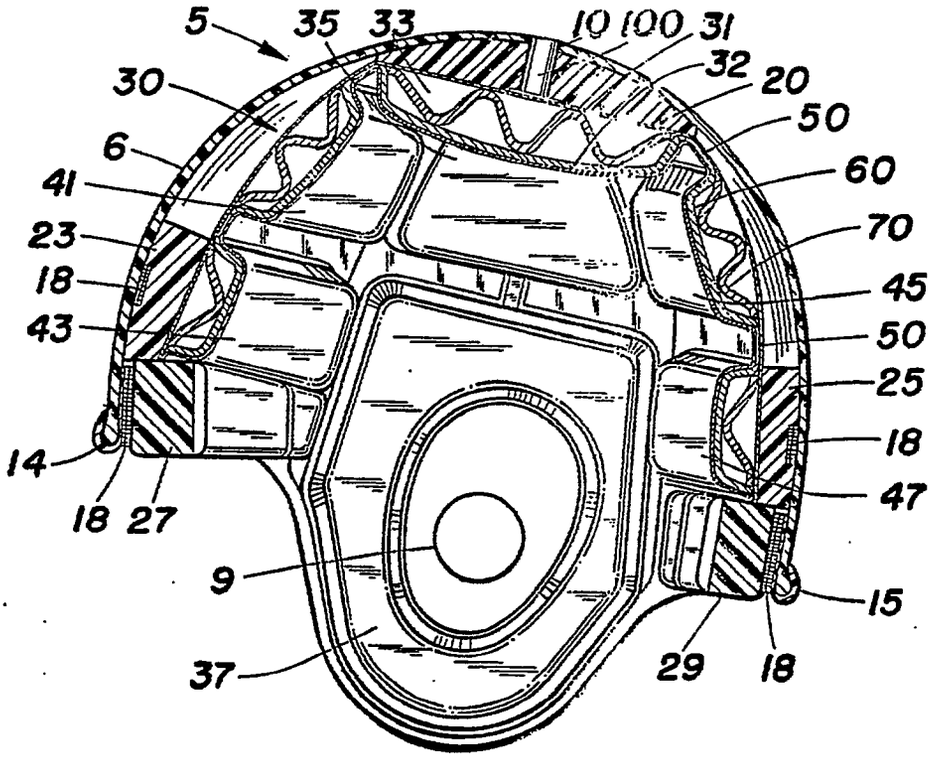

5
35
33
10
100
31
32
20
30
50
6
60
41
70
23
45
18
50
43
25
18
14
47
18
27
9
15
37
29
18

Fig. 4

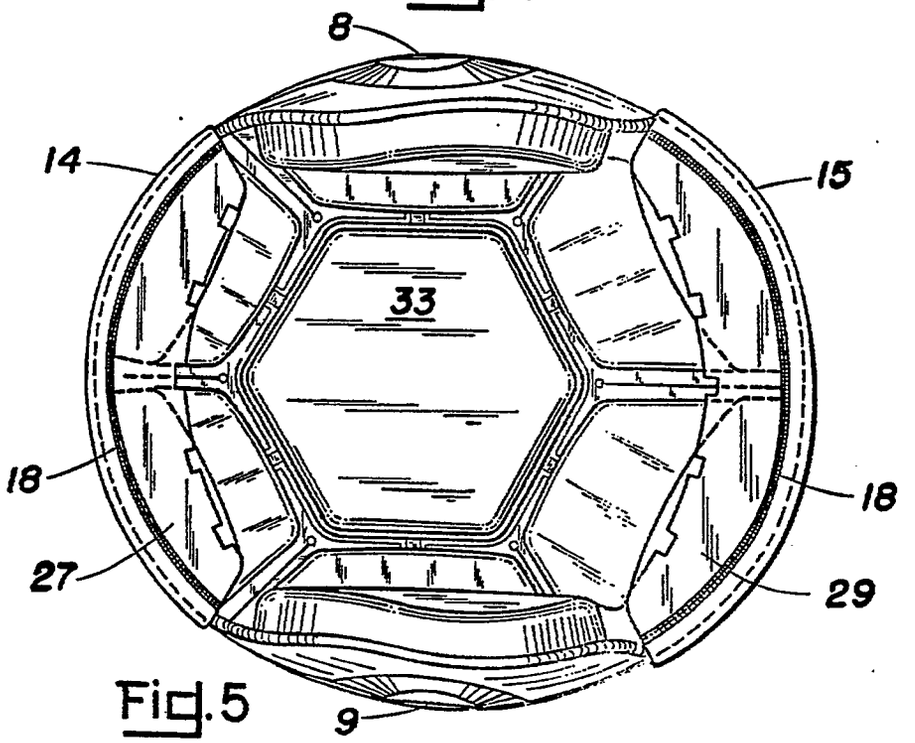

8
14
15
33
18
18
27
29
9

Fig. 5

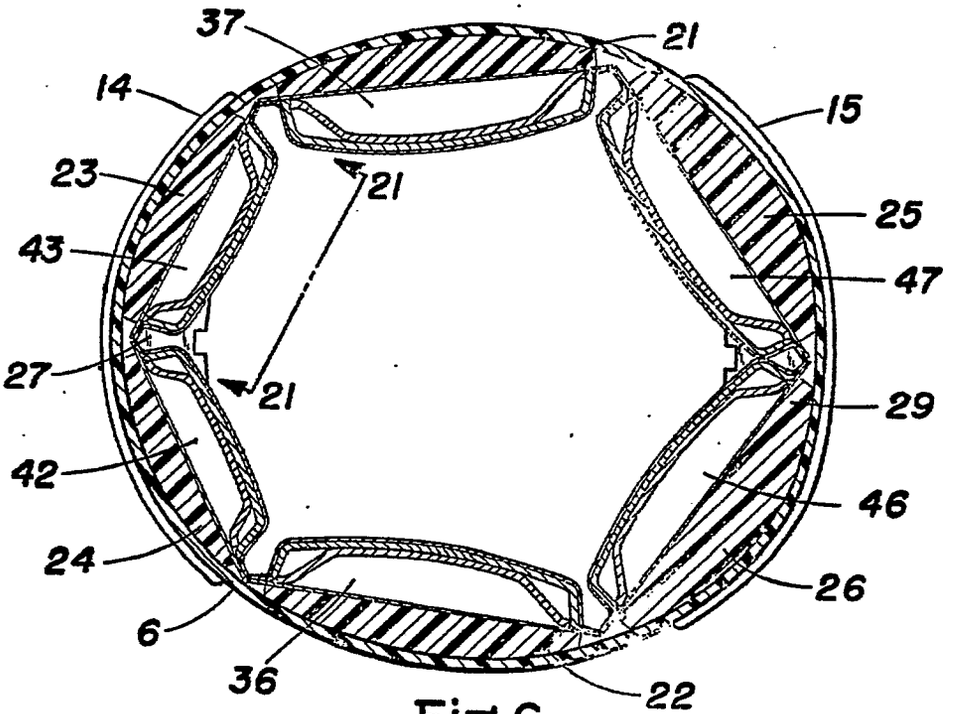


Fig.6

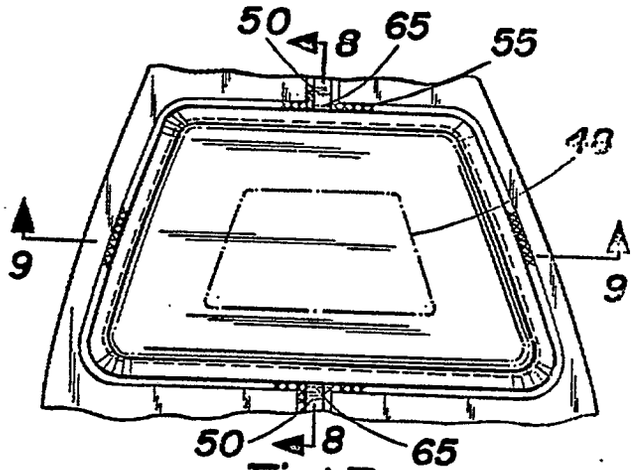


Fig.7

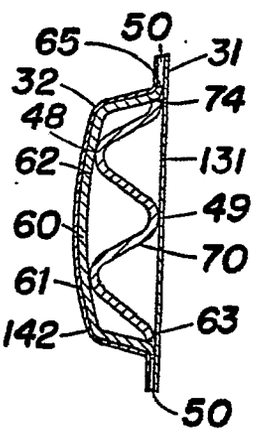


Fig.8

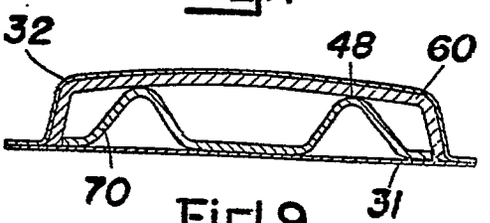


Fig.9

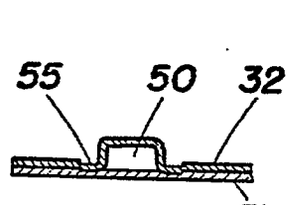


Fig.12

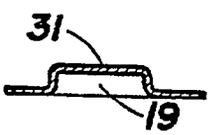


Fig.13

Fig.10



Fig.11

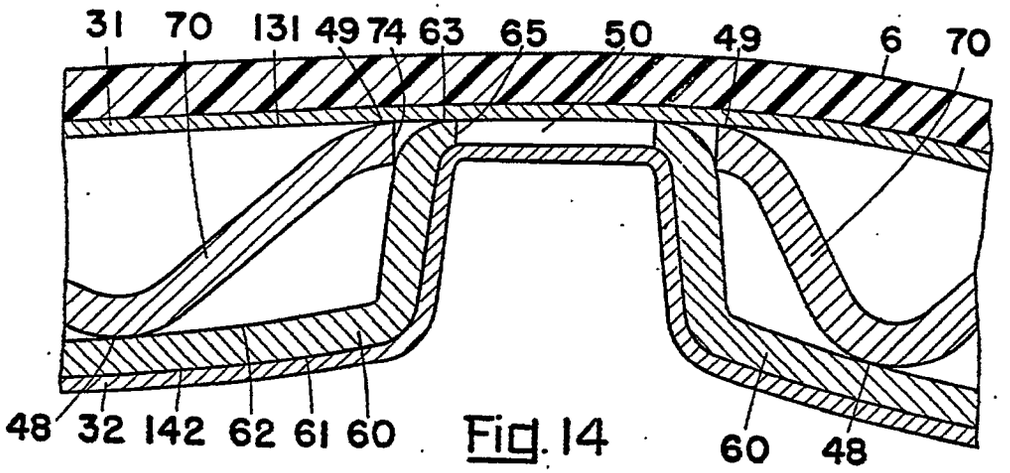


Fig. 14

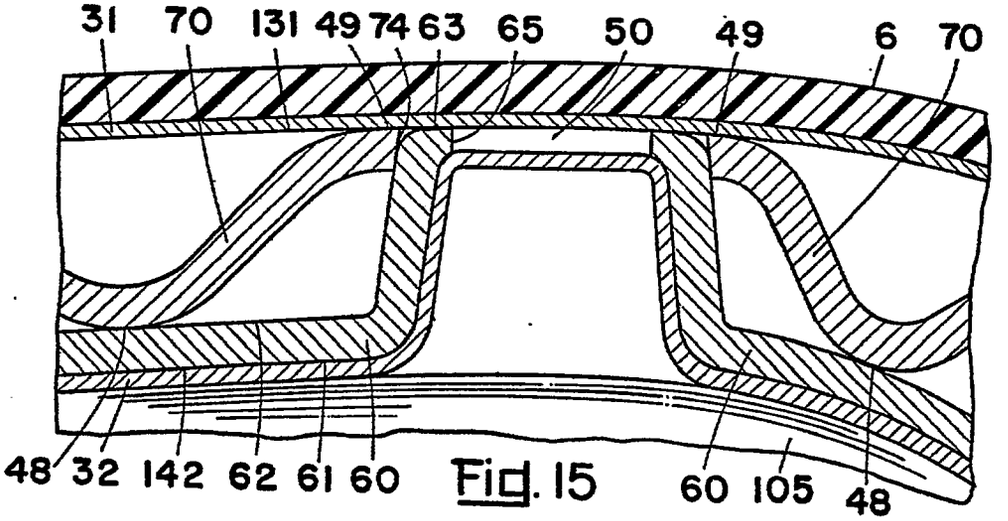


Fig. 15

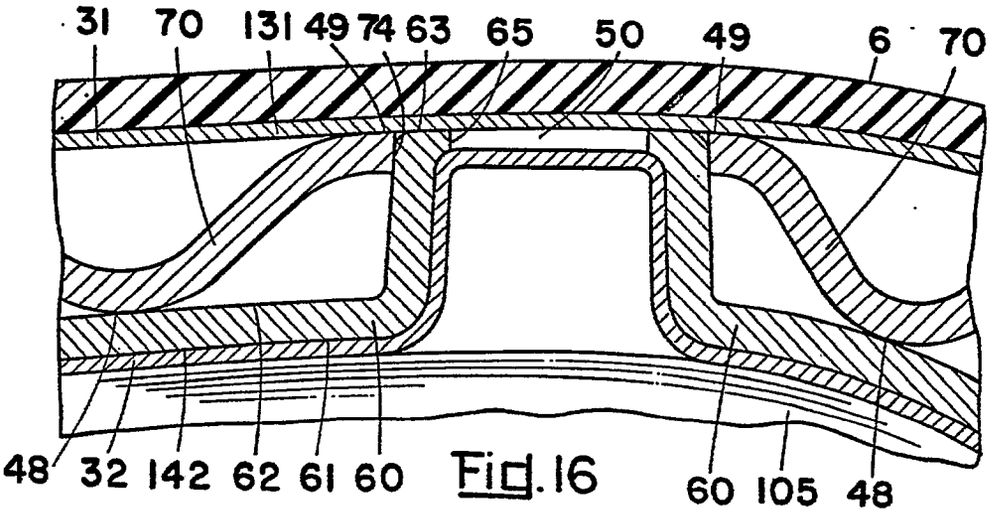


Fig. 16

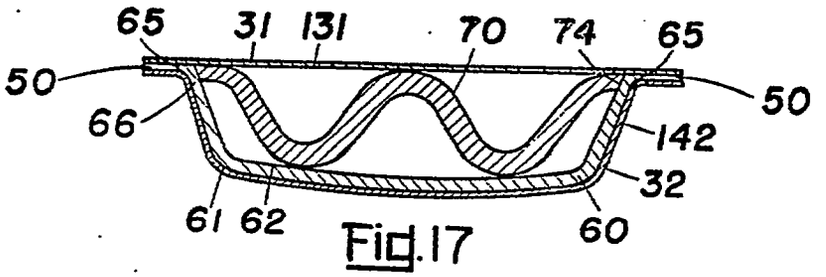


Fig.17

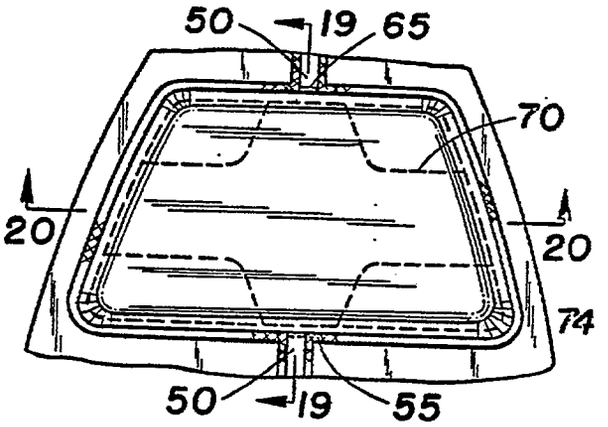


Fig.18

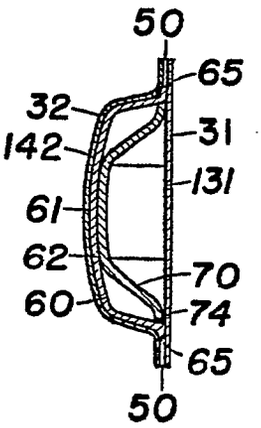


Fig.19

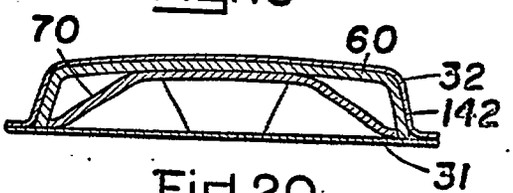


Fig.20

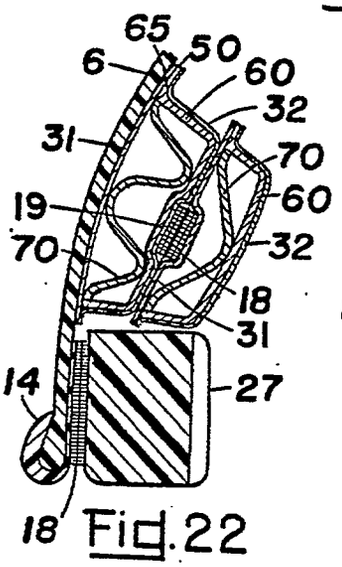


Fig.22

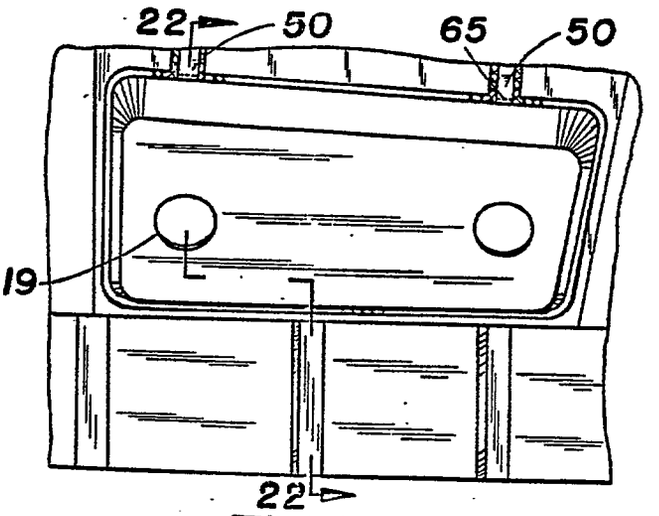


Fig.21

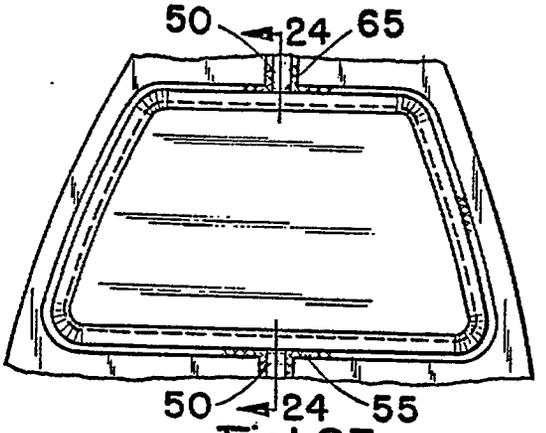


Fig.23

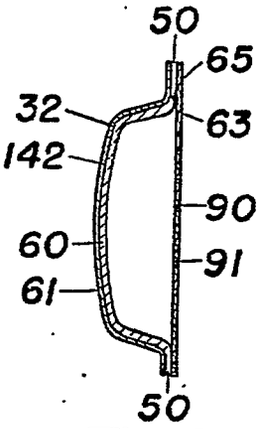


Fig.24

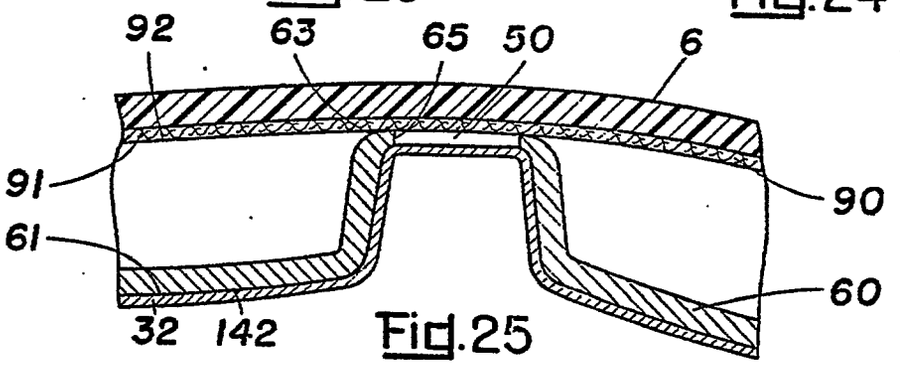


Fig.25

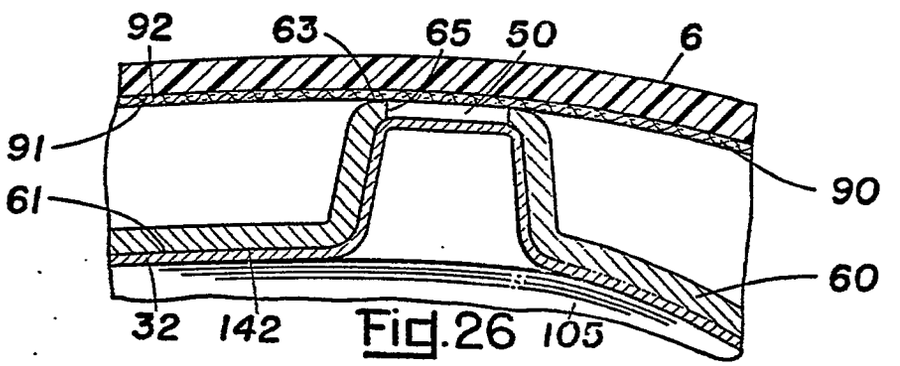


Fig.26

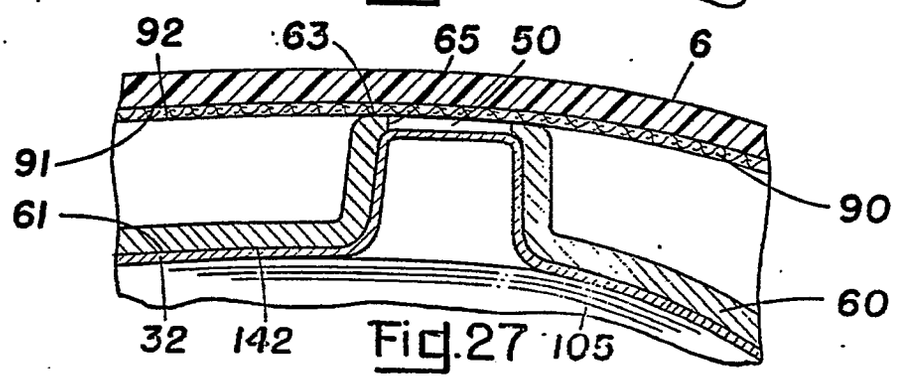


Fig.27