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(54) **A protective appliance for protecting the top of the femur of an individual**

(57) The present invention relates to a protective appliance to be worn by an individual for protecting the top of the femur of the individual. The protective appliance comprises a mechanical impact absorbing pad made from an elastically deformable and recoverable material allowing the material itself to absorb a mechanical impact

through deformation of the material and to recover to its initial configuration after the mechanical impact, and a waterproof enclosure enclosing the mechanical impact absorbing pad for sealing off the mechanical impact absorbing pad.

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Description

[0001] The present invention relates to the technical field of protecting an individual against body injury, and more particularly, to the technical field of protecting the top of the femur of the individual's body against injury through mechanical impact. The present invention further generally relates to a protective appliance to be worn by the individual for protecting the top of the femur of an individual's body against injury through mechanical impact.

[0002] An extremely large number of hip fractures are registered each year. Hip fractures are particularly common to elderly people and individuals suffering from weakened bones, e.g. osteoporosis, neurotic disorder, e.g. Alzheimer's disease, and further to individuals having weakened bones caused by extensive medication which may cause weakening of the bones of the individual and further in numerous instances may cause the individual to be confused and make the individual susceptible to slipping, falling, or otherwise to be exposed to mechanical severe impacts which may cause bone fractures, such as hip fractures. Numerous protective appliances have been developed for protecting in particular hip joints of individuals. Among the references disclosing protective appliances of the above type, reference is made to US Patent No. 3,044,075, US Patent No. 3,484,868, US Patent No. 3,465,364, US Patent No. 4,641,641, US Patent No. 4,926,883, US Patent No. 5,062,433, US Patent No. 5,289,830, US Patent No. 5,557,804, US Patent No. 5,636,377 and US Patent No. 5,722,093, which are further hereby incorporated in the present specification by reference.

[0003] The applicant has successfully sold appliances in the technical field for the general protection of body parts, e.g. the elbows, the shoulders, the back, the chest, the hip joint, the buttocks, the knees, etc.

[0004] Although the protective appliances may provide protection to the individual wearing the protective appliance, the protective appliance often on the one hand causes severe discomfort, while the protective appliance is worn by the individual in question, and on the other hand is extremely difficult to apply and maintain in correct positioning relative to the hip joint, especially relative to the top of the femur since it moves relative to the skin and thus the clothes when the person shifts position, e.g. from standing to sitting, etc. Most protective appliances to be used for hip joint protection and for top of the femur protection are to be fixated relative to the skin surface of the individual through adhesive fixation, or alternatively to be fixated by means of belts or similar fixation elements. A further protective appliance is known which is adapted to be received within a pocket of a pair of underpants to be worn by the individual. The correct positioning of the protective appliance, which is received in the pocket of the underpants, however, is completely dependent on a correspondence between the anatomy of the individual wearing the underpants and the intentional

anatomy of the design of the underpants.

[0005] An object of the present invention is to provide a protective appliance, which can absorb and distribute the mechanical impact to which the appliance is subjected.

[0006] An object of the present invention is to provide a protective appliance, which is easily positioned and fixated relative to the top of the femur of the individual by the individual wearing the protective appliance.

[0007] An object of the present invention is to provide a protective appliance for the protection of the top of the femur which appliance, regardless of which positions (standing, walking, sleeping, etc) the individual has placed oneself in, is convenient to wear.

[0008] An object of the present invention is also to provide a protective appliance for the protection of the top of the femur, which protective appliance - when subjected to a mechanical impact regardless of which position the individual has placed oneself in - protects the top of the femur from the mechanical impact.

[0009] An object of the present invention is to provide a protective appliance for the protection of the top of the femur which appliance when subjected to sweat, urine, body fluids, water or other liquids as well does not get deteriorated during its use.

[0010] Consequently, it is an object of the present invention that the appliance can be washed and tumble-dried without deterioration.

[0011] If an appliance is to be worn for the protection of the top of the femur of the individual this appliance of course is to worn regardless of which position (standing, walking, sleeping, etc) the individual has placed oneself in.

[0012] By experiments the applicant has proven that the shape of the appliance according to the invention for the protection of the top of the femur to be worn is an important parameter. The shape is important so that the appliance is convenient to wear and also provides protection of the top of the femur in all uses and all positions the individual could place oneself in.

[0013] By experiments the applicant has proven that to shield the top of the femur from a mechanical impact properly, it is important that the mechanical impact is distributed from the point where it struck the protective appliance to the whole area of the body covered by the protective appliance, i.e. the mechanical impact is bridged to the area of the body covered by the protective appliance. Consequently, the part of mechanical impact reaching the top of the femur is minimised.

[0014] Moreover, the applicant has in the construction of the protective appliance also focused on the aesthetic look of the individual wearing the protective appliance inside the clothes or outside the clothes. For that reason the applicant has made the protective appliance to be in a thickness of only 1-2 centimetres. Accordingly, especially if worn inside the clothes, for example in the pocket of a pair of trousers, it is difficult to see that the protective appliance is used.

[0015] A particular feature of the present invention relates to the fact that a protective appliance to be used for protecting the top of the femur is, in accordance with the teaching of the present invention, provided comprising a minimum number of components, which are easily fixated relative to the top of the femur in question by the individual or personnel nursing the individual, through the utilisation of the ordinary clothing of the individual.

[0016] The above object, the above advantage, and the above feature together with numerous other objects, advantages, and features which will be evident from the below detailed description of the present invention are in accordance with the teaching of the present invention obtained by a protective appliance according to the present invention to be worn by an individual for protecting the top of the femur of the individual comprising a mechanical impact absorbing pad made from an elastically deformable and recoverable material allowing the material itself to absorb a mechanical impact through deformation of the material and to recover to its initial configuration after the mechanical impact, and a waterproof enclosure enclosing the mechanical impact absorbing pad for sealing off the mechanical impact absorbing pad, the waterproof enclosure comprises a waterproof fabric being permeable to atmospheric air including steam. Hereby a simple construction is obtained constituting few parts, which construction is easily worn and can be washed and tumble-dried without deterioration. The mechanical impact absorbing pad comprising one or two layers of open cell foam or one or more gel cushions possibly in combination with the open cell foam.

[0017] According to the teaching of the present invention, the protective appliance further comprising a shielding element of a generally convex configuration defining an outer convex surface and an inner concave surface being made from a flexible material, preferably a plastic material, the mechanical impact absorbing pad being concealed by the inner concave surface. The shielding element defines an outer circumferential rim defining substantially a single plane. This ensures when the shielding element is in contact with the individual wearing the protective appliance that it by means of the rim is in contact with the skin or the clothes along the whole of the rim. Hereby, any mechanical impact to which the protective appliance is subjected will be transferred to some extent to the rim before subjecting the skin surrounding the top of the femur. In addition the pad also assist in distributing the mechanical impact.

[0018] According to the teaching of the present invention an embodiment is provided in which the inner concave surface of the shielding element is fixated to the waterproof enclosure.

[0019] According to the teaching of the present invention an embodiment is provided in which the inner concave surface of the shielding element is contacted with the mechanical impact absorbing pad, the shielding element and the mechanical impact absorbing pad thus being enclosed by the waterproof enclosure, e.g. a water-

proof fabric.

[0020] According to the teaching of the present invention an embodiment is provided in which the inner concave surface of the shielding element is contacted with the mechanical impact absorbing pad and the shielding element and is sealed by the waterproof fabric, the mechanical impact absorbing pad and the shielding element together constituting the waterproof enclosure.

[0021] According to the teaching of the present invention the side of the mechanical impact-absorbing pad is contacted with the individual defining an area constituting an impact zone of a substantially rectangular configuration. The substantially rectangular configuration having round corners defining a width and a height, the height corresponds to the longitudinal direction of the individual. The width is seen perpendicular to the height and the dimension of the width is greater than or equal to the dimension of the height. The dimension of the width is 110 - 160 mm, such as 110-150 mm, e.g. 115 - 140 mm, preferably 115 - 135 mm, further preferably 115 - 125 mm, 115 - 120 mm, 125 - 130 mm, 130 - 135 mm, 135 - 140 mm, 140 - 145 mm, 145 - 150 mm, 150 - 155 mm and 155 - 160 mm.

[0022] The above object, the above advantage, and the above feature together with numerous other objects, advantages, and features which will be evident from the below detailed description of the present invention are in accordance with the teaching of the present invention obtained by a protective appliance according to the present invention to be worn by an individual for protecting the top of the femur of the individual, which femur is covered by a piece of clothing, where the shielding element at the outer convex surface comprises fixation elements for co-operating the protective appliance to the piece of clothing worn by the individual and covering the top of the femur of the individual, and a central curved segment integrally connected to the fixation elements. The fixation elements comprise one of burr tape, a permanent non permanent binder, a flange or a recess.

[0023] According to the teaching of the present invention, an embodiment is provided where the protective appliance further comprises a cover element to be arranged opposite to the shielding element relative to the piece of clothing so as to sandwich the piece of clothing between the shielding element and the cover element. The cover element of a generally convex configuration comprises opposite apertures or flanges and a central curved segment integrally connected to the apertures or flanges, the apertures or flanges being arranged to co-operate with the fixation elements of the shielding element, whereby the cover element and the shielding element are connectable to one another. The connection between the apertures or flanges and the fixation elements can be utilised to sandwich the piece of clothing between the shielding element and the cover element. The generally convex configuration of the shielding element is optionally provided with apertures or flanges.

[0024] According to the teaching of the present inven-

tion, an embodiment is provided where the generally convex configuration of the cover element optionally is provided with apertures or flanges co-operating with flanges or apertures, respectively, on the shielding element.

[0025] According to the teaching of the present invention an embodiment is provided where the pad has a support pressure from 1.4 to 1.6 PSI, e.g. 1.5 PSI.

[0026] The invention will be explained more fully below in connection with preferred embodiments and with reference to the drawings, in which:

Fig. 1 is a top perspective view of an embodiment of the protective appliance comprising a pad, a shielding element and a waterproof enclosure,

Fig. 2 is a view of an embodiment showing how the protective appliance is applied by an individual wearing it,

Fig. 3 is an exploded view of an embodiment of the protective appliance comprising a pad, a shielding element, a waterproof enclosure and a cover element,

Fig. 4 is a top perspective view of an embodiment of the protective appliance comprising a pad, a shielding element and a waterproof enclosure,

Fig. 5 is a top perspective view of an embodiment of the protective appliance comprising a pad and a waterproof enclosure,

Fig. 6 is a top perspective view of an embodiment of the protective appliance comprising a pad, a waterproof enclosure and a shielding element,

Fig. 7 is a view of an embodiment showing the protective appliance applied by an individual wearing it in various positions in which the individual could place oneself,

Fig. 8 is a view of an embodiment showing the protective appliance applied covering the top of the femur, and

Figs. 9a, 9b and 9c are views of an embodiment of the protective appliance comprising a pad and a shielding element subjected to a mechanical impact.

[0027] Throughout the drawings, the same reference numerals indicate identical elements or components. In the present specification, components or elements identical to components or elements, respectively, described previously with reference to a preceding figure are designated the same reference numerals and components or elements differing from previously described components or elements, respectively, however serving the same overall purpose, are designated the same integer

as the previously described component or element, however, added a marking for identifying the structural difference from the previously described component or element.

[0028] Figs. 1 and 3 show an embodiment of the protective appliance 10 comprising a pad 14, 16, a shielding element 12 and a top and bottom of a waterproof enclosure denoted by 26 and 28, respectively.

[0029] In the preferred embodiment, the protective appliance 10" only comprises the pad 14' and the waterproof enclosure 26', see figure 5. In this embodiment the pad comprises a single layer of material.

[0030] Basically, the pad, which e.g. is a mechanical impact absorbing pad, is made from an elastically deformable and recoverable material. The material allows itself to absorb a mechanical impact through deformation of the material and to recover to its initial configuration after the mechanical impact. The waterproof enclosure is made from a waterproof fabric. The waterproof fabric, Decu-Tex, which has been applied by the applicant, allows up to 1000 g of aqueous vapour per m² per day. The substance maintains all characteristics e.g. watertightness and wearability. Substances having a higher permeability tend to perform less with respect to watertightness and wearability along with having a weaker resistance chemicals - some substances will even swell when they become wet. The fabric being tolerable to aqueous vapour is advantageous for two reasons: non-irritable to the skin and comfortable for the individual. Experiences with vapour-proofed foils used as dressing show that a permeability of approx. 1.000 gr/m² per day at 37 C and 100 % RH (Relative Humidity), is required in order to maintain normal conditions for the skin and at the same type offer comfort. The polyurethane foil, which is being used, remains 100% waterproofs and reduces the risk of virus. Provided that the foam mattress is not partly covered with PVC, the body humidity will, to begin with, be absorbed by the cover, after which it will evaporate out into the atmosphere.

[0031] The unpleasant qualities that rubber, PVC and polyethylene have are well known and can be minimised. The foil - as a waterproof enclosure - maintains a balance between aqueous vapour-permeability and other important characteristics in the coating which one often comes in contact with when working with hospital mattresses. It can be described as follows: bacteria static or antibacterial, fungi inducing or work as a fungicide and anti microbial. Superficial dirt on the cover of the enclosure can be removed with a moist cloth with a neutral detergent. Tougher dirt can be removed by first applying methyl alcohol and afterwards rinsing with warm water and detergent. Cleaning and disinfection can be done with lukewarm water and a neutral detergent or with a sodium hypochlorite solution (0,1 % or 1000 parts per million parts chlorine). When using regular detergent the material can be washed at max. 95 degrees C. The material may be air-dried, spin-dried, or tumbler-dried at temperatures of up to 130 degrees C. The material is poly-

urethane foil laminated with knitted nylon, with the general characteristics of Nylon 66 fabric and weldable. Fire retardant according to British standard BS 7175. It is proof for dust mites - allergy friendly. Sanitised® treated to prevent growth of fungus and bacteria. Breathable - does not feel warm or damp/moist. Waterproof for up to a 3,5m column of water. It contains no azo-dyes or formaldehyde. Composition: 42% PU, 58% PA, Cover adhesion (N/50 mm) 35 at the minimum, resistance to water (kPa) 35 at the minimum.

[0032] Returning to figure 1 and 3, the waterproof enclosure as discussed comprises a top part 26 and a bottom part 28, which parts together are used to seal off the pad. The pad comprises two layers 14 and 16. Any of these is made of open cell foam. The pad, "Sunmate" Cushion Material, which has been applied by the applicant, is of a chemical family of flexible modified polyurethane open-cell foam designed to provide comfortable orthopaedic support, in combination with impact energy absorption. This is a family of flexible cushion materials available in a wide range of support pressures from extremely soft to extremely firm. Typical applications are for wheelchair seat cushions, e.g. aircraft ejection seats, racecar impact padding and special body protection, e.g. for the top of the femur. It has a density of approximately 5 to 6 lb/ft³. It is in a white cellular foam (pigment added for colour). The material is small open tightly constricted cell structure with a negligible odour. It has energy absorption, which can be varied from 2 ft-lb/in³ to 12 ft-lb/in³ with a 0.05 to 0.2 rebound coefficient. This is an efficient impact, vibration and sound absorbing cushion material. It is also referred to as visco-elastic, slow flow or memory foam. It comprises a thermo-elastic material with elastic properties that can be controlled to vary with temperatures. Normal use ranges from 20 F to 130 F, extreme use capability from 0 F to 200 F depending on the specific material. It will not degrade in boiling water or sub-zero temperature and can be sterilised at temperatures up to 250 F. High humidity or water will not degrade the foam. The tight open cell structure inhibits water penetration. Submerged water absorption rate varies between 1% and 5% in a 24-hour period depending on foam density. It will not ignite from constant exposure to burning cigarettes. Decomposition out gassing occurs at extended exposure to temperatures in excess of 350 F. Extended temperatures in excess of 400 F may produce combustible gasses if contained in a proper mixture with air. It is a slow burning, self-crusting, non-drip cushion material and requires fire retardant coatings to meet strict aircraft and government fire retardant codes. Fumes emitted by the material under fire conditions have a low-acid toxicity, which allows them to be breathable for an extended period of time. These materials are known not to cause skin irritation and are considered non-allergic. The solid foam material is considered non-toxic and non-hazardous.

[0033] However, any one of these pad layers or both layers of the pad could be made out of a gel cushion, e.g.

gel enclosed by a waterproof material, e.g. enclosed and sealed in a plastic bag or in a woven fabric. It is possible that the support pressure in PSI, i.e. body weight (in lbs.) divided by contact area (in square inches), for the pad layers could differ, e.g. the first layer could have a relatively high support pressure, whereas the second layer could have a relatively low support pressure, i.e. the second layer is soft as compared to the first layer. These layers could be reversed. In the construction of the protective appliance the layer or layers is/are selected to on the one hand side to provide impact protection for the top of the femur and on the other hand side to provide convenience, e.g. feeling soft when worn, to the individual. A typical support pressure for the pad at around 1.5-PSI, e.g. 1.4 - 1.6 PSI has proven to give adequate impact protection for the top of the femur. In another preferred embodiment, the protective appliance comprises a shielding element 12. The pad is concealed by an inner concave surface 19 of the shielding element and this element is fixated to the waterproof enclosure, and these two elements all together then can be sealed by the waterproof enclosure, i.e. the outer convex surface 24 of the shielding element is then covered by the waterproof enclosure being the waterproof fabric. The fixation is performed by means of welding or gluing 30.

[0034] The shielding element 12 comprises an outer circumferential rim 17. This rim is essentially in the same plane. This ensures when the shielding element is in contact with the individual wearing the protective appliance that it correspondingly - by means of the rim - is in contact with the skin or the clothes along the whole of the rim. Hereby, any mechanical impact to which the protective appliance is subjected will be transferred to some extent to the rim before subjecting the skin surrounding the top of the femur. In addition - which will be shown by means of figures 9a, 9b and 9c - the pad 14, 16 also assists in distributing the mechanical impact.

[0035] The shielding element 12 is made from a flexible material and comprises an outer convex surface 24.

[0036] Moreover, the shielding element 12 is provided with fixation elements, for example a flange 20 as shown, alternatively burr tape, a non permanent binder could be applied to enable the protective appliance 10 to co-operate with a piece of clothing worn by the individual. Typically the fixation elements are located on the outer convex surface and a central curved segment 13 is integrally connected to the fixation elements 20. In order to make the flange 20 flexible (and the material to which it is fixed), the flange is located proximate a mouth opening 22.

[0037] The shielding element 12 is provided with apertures or venting holes 18. These enable the pad to breathe 14, 16 and to dry if subjected to damp or humidity, moreover these holes prevent the protective appliance from being too warm when worn, since these holes can help transport the warmth from a hot pad (warmed by the body) through the waterproof enclosure away from the individual.

[0038] In another preferred embodiment, the protec-

tive appliance additionally comprises a cover element 32. This comprises a central curved segment 38 integrally connected to apertures 34 and 36.

[0039] The cover element is provided with fixation elements, for example a recess 34, which is adapted to co-operate with the corresponding fixation element on the shielding element 12, e.g. the flange 20. Alternatively burr tape or a non-permanent binder could be applied to enable the cover element 32 to co-operate with the shielding element.

[0040] When the recess is provided on the cover element 32 this recess or recesses together with a flange or flanges 20 on the shielding element 12 can be utilised to sandwich a piece of clothing between the cover element and the shielding element.

[0041] Alternatively, the recess(es) is/are provided on the shielding element 32 and a flange or flanges is/are provided on the cover element 12 achieving the same sandwiching function.

[0042] The cover element 32 is as discussed provided with apertures or venting holes 34 and 36. These enable the pad to breathe and to dry through these holes, if the pad is subject to damp or humidity. Moreover, these holes prevent the protective appliance to be too warm when worn, since these holes can help transport the warmth from a hot pad (warmed by the body) through the waterproof fabric, through the shielding element to the cover element and away from the individual.

[0043] The shielding element and the cover element are made from a flexible material, e.g. a durable and preferably fairly rigid plastic material or similar material, e.g. thermoplastics or thermosetting materials, such as PE (polyethylene), ABS (acrylonitril butadiene styrene), PP (polypropylene), PC (polycarbonate), composite materials including fibre glass, glass fibre reinforced plastic materials, carbon fibre reinforced plastic materials, and combinations thereof, or alternatively aluminium or the like. The shielding element and the cover element each may be produced by casting, moulding, cutting, pressure forming, or combinations thereof.

[0044] Fig. 2 is a view of an embodiment showing how the protective appliance 10 is applied by an individual wearing it. This applies to the embodiments already mentioned and also applies to embodiments disclosed in the following. As an example all elements from figure 3 could be sandwiched together and worn in the pocket of the pants. Alternatively, all elements from figure 3 with the exception of the cover element could be sandwiched together and worn in the pocket of the pants.

[0045] However, the individual could choose to use the cover element connected to the outside of the pants whereby the fabric of the pants is sandwiched between the shielding element 12 of protective appliance 10 and the cover element 32.

[0046] Fig. 4 is a top perspective view of an embodiment of the protective appliance 10' comprising a pad, a shielding element and a waterproof enclosure. In this embodiment, the shielding element is located inside and sur-

rounded by the waterproof enclosure. Here, the inner concave surface 19 (see fig. 3) of the shielding element 12' is contacted with the mechanical impact absorbing pad 14, 16. The shielding element 12' and the mechanical impact absorbing pad 14' are enclosed by the waterproof enclosure 26'. However, in this embodiment the shielding element is not provided with any fixation elements, and in this embodiment only a single layer of the pad is applied as shown by means of 14'.

[0047] Fig. 5 shows an embodiment of the protective appliance 10" comprising the pad 14' and the waterproof enclosure 26". The pad comprises one layer 14".

[0048] Fig. 6 is a top perspective view of an embodiment of the protective appliance 10''' comprising a pad, a waterproof enclosure and a shielding element. Here, the elements from figure 3 - apart from the cover element - are applied in a further embodiment of the protective appliance. The inner concave surface 19 (see fig. 3) of the shielding element is contacted with the mechanical impact absorbing pad 14''' and the shielding element is sealed by the waterproof fabric. Thus the mechanical impact absorbing pad 14" and the shielding element together constitute the waterproof enclosure. This is the case since the waterproof enclosure, e.g. the waterproof fabric, is mounted to cover the convex surface 24 (see fig. 3) of the shielding element and additionally this fabric is mounted, e.g. by glue, welding or by other means fixated to the corners of the pad leaving the pad part not facing the shielding element uncovered.

[0049] Fig. 7 is a view of an embodiment showing the protective appliance 10''' applied by an individual wearing it in various positions the individual could place oneself in. As can be seen in the figure, the leg of the individual can be moved and rested in various positions. Accordingly, the top of the femur - as indicated by the four crosses - moves to different positions. The applicant has proved that a rectangular configuration of the mechanical impact absorbing pad gives adequate protection of the femur - see figure 8 - in all uses and positions the individual could place herself or himself in. More precisely, the side of the pad to be contacted with the individual defines an area, which - for the reasons mentioned above - constitutes an impact zone of a substantially rectangular configuration. This configuration is chosen to ensure that positions of the top of the femur are inside the rectangle.

[0050] The substantially rectangular configuration typically has round corners. It defines a width 48 and a height 49 of the rectangle, the height 49 corresponding to the longitudinal direction of the individual, whereas the width is perpendicular to the height. The side of the pad has its dimension of the width to be greater than or equal to the dimension of the height.

[0051] The dimension of the width 48 is 110 - 160 mm, such as 110-150 mm, e.g. 115 - 140 mm, preferably 115 - 135 mm, further preferably 115 - 125 mm, 115 - 120 mm, 125 - 130 mm, 130 - 135 mm, 135 - 140 mm, 140 - 145 mm, 145 - 150 mm, 150 - 155 mm and 155 - 160 mm.

[0052] Figure 8 is a view of an embodiment showing

the protective appliance 10"" applied covering the top of the femur. Typically, the protective appliance is worn in a pocket of a pair of trousers or in both pockets of the trousers.

[0053] The figures 9a, 9b and 9c are views of an embodiment of the protective appliance showing the pad 14"" and the shielding element 12" subjected to a mechanical impact.

[0054] Figure 9a shows a situation where the protective appliance has just been hit by the mechanical impact indicated by the arrow, which impact in the first place forces the shielding element if any, and the waterproof enclosure to bend inwardly towards the pad.

[0055] Secondly, in figure 9b, the pad assists in distributing the mechanical impact as indicated by the three arrows.

[0056] Finally, in figure 9c, the pad further assists in distributing the mechanical impact as indicated by the five arrows, where the material of the pad itself absorbs the impact through deformation of the material.

[0057] As a result the mechanical impact is substantially distributed all over the area covered by the protective appliance, which in a typical application covers - as shown in figure 8 - the top of the femur and the area around it. Consequently, the impact reaching the top of the femur is minimised. Thus the top of the femur is shielded from the mechanical impact properly, i.e. the mechanical impact - as indicated by the eight arrows - is bridged from the point where it struck the protective appliance to the whole area of the body covered by the protective appliance. Consequently, the part of mechanical impact reaching the top of the femur is minimised.

[0058] During the impact, the pad - of a recoverable material - allows the material itself to absorb the impact through deformation of the material. After the impact the material recovers to its initial configuration, i.e. as it was before the mechanical impact.

Claims

1. A protective appliance to be worn by an individual for protecting the top of the femur of said individual, said protective appliance comprising:

a mechanical impact absorbing pad made from an elastically deformable and recoverable material allowing said material itself to absorb a mechanical impact through deformation of said material and to recover to its initial configuration after said mechanical impact, and
a waterproof enclosure enclosing said mechanical impact absorbing pad for sealing off said mechanical impact absorbing pad.

2. The protective appliance according to claim 1, said waterproof enclosure comprises a waterproof fabric.

3. The protective appliance according to claim 2, said waterproof fabric being permeable to atmospheric air including steam.

4. The protective appliance according to any of the preceding claims, said mechanical impact absorbing pad comprising one or more layers of open cell foam and/or one or more gel cushions.

5. The protective appliance according to any of the preceding claims further comprising a shielding element of a generally convex configuration defining an outer convex surface and an inner concave surface being made from a flexible material, preferably a plastic material, said mechanical impact absorbing pad being concealed by said inner concave surface.

6. The protective appliance according to claim 5, said shielding element defining an outer circumferential rim defining substantially a single plane.

7. The protective appliance according to any of the claims 1 to 6, said inner concave surface of said shielding element being fixated to said waterproof enclosure.

8. The protective appliance according to any of the claims 1 to 6, said inner concave surface of said shielding element being contacted with said mechanical impact absorbing pad, said shielding element and said mechanical impact absorbing pad being enclosed by said waterproof enclosure.

9. The protective appliance according to any of the claims 1 to 6, said inner concave surface of said shielding element being contacted with said mechanical impact absorbing pad and said shielding element being sealed by said waterproof fabric, said mechanical impact absorbing pad and said shielding element together constituting said waterproof enclosure.

10. The protective appliance according to any of the preceding claims, the side of said mechanical impact absorbing pad to be contacted with said individual defining an area constituting an impact zone of a substantially rectangular configuration.

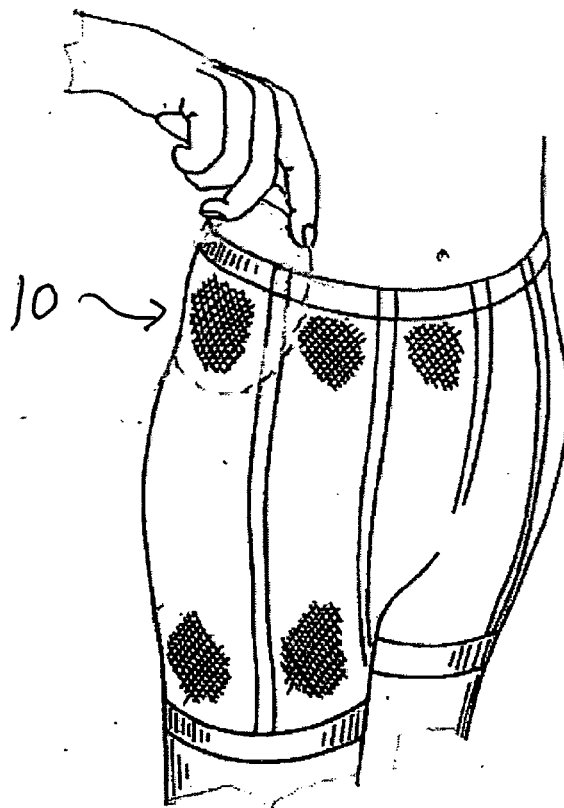
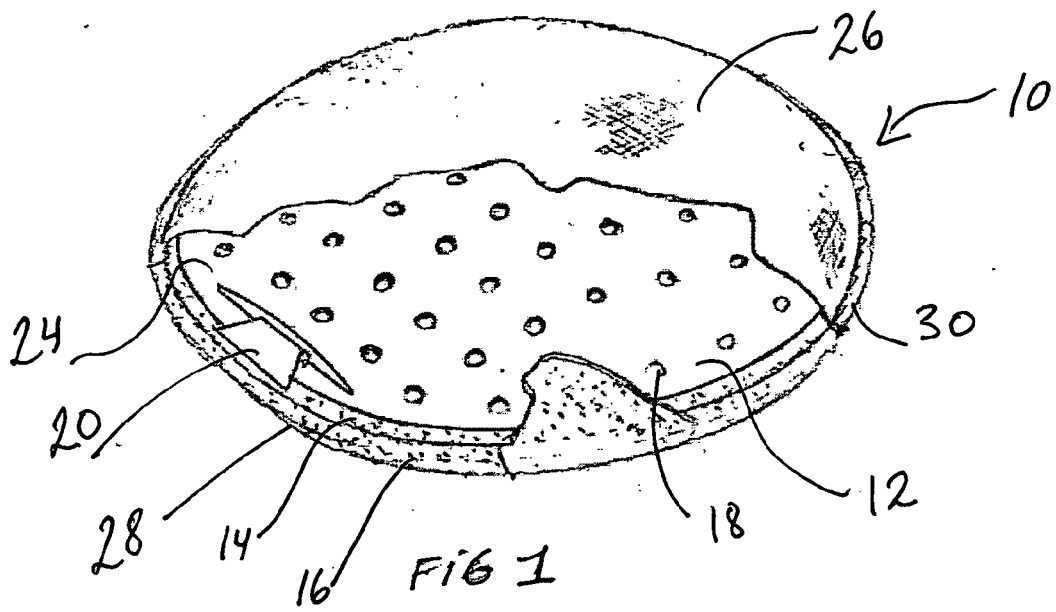
11. The protective appliance according to claim 10, said substantially rectangular configuration having round corners defining a width and a height, the height corresponding to the longitudinal direction of said individual, the width being perpendicular to said height, the dimension of said width being greater than or equal to the dimension of said height.

12. The protective appliance according to claim 11, the dimension of said width being 110 - 160 mm, such

as 110-150 mm, e.g. 115 - 140 mm, preferably 115 - 135 mm, further preferably 115 - 125 mm, 115 - 120 mm, 125 - 130 mm, 130 - 135 mm, 135 - 140 mm, 140 - 145 mm, 145 - 150 mm, 150 - 155 mm and 155 - 160 mm.

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13. The protective appliance according to claims 5 to 12 to be worn by said individual for protecting the top of the femur of said individual, which femur is covered by a piece of clothing, said shielding element at said outer convex surface comprising fixation elements for co-operating said protective appliance to said piece of clothing worn by said individual and covering said top of the femur of said individual and a central curved segment integrally connected to said fixation elements. 10 15
14. The protective appliance according to claim 13, said fixation elements comprising one of burr tape and a permanent non permanent binder. 20
15. The protective appliance according to claim 13 or 14, said protective appliance further comprising a cover element to be arranged opposite to said shielding element relative to said piece of clothing so as to sandwich said piece of clothing between said shielding element and said cover element. 25
16. The protective appliance according to claim 15, the cover element of a generally convex configuration comprising opposite apertures and a central curved segment integrally connected to said apertures, said apertures being arranged to co-operate with said fixation elements of said shielding element, whereby said cover element and said shielding element are connectable to one another. 30 35
17. The protective appliance according to claim 16, said connection between said apertures and said fixation elements can be utilised to sandwich the piece of clothing between said shielding element and said cover element. 40
18. The protective appliance according to claims 13 to 17, the generally convex configuration of said shielding element being optionally provided with apertures. 45
19. The protective appliance according to claims 16 to 17, the generally convex configuration of said cover element being optionally provided with apertures. 50
20. The protective appliance according to any of the preceding claim, said pad having a support pressure from 1.4 to 1.6 PSI. 55
21. The protective appliance according to any of the preceding claim, said pad having a support pressure around 1.5 PSI.



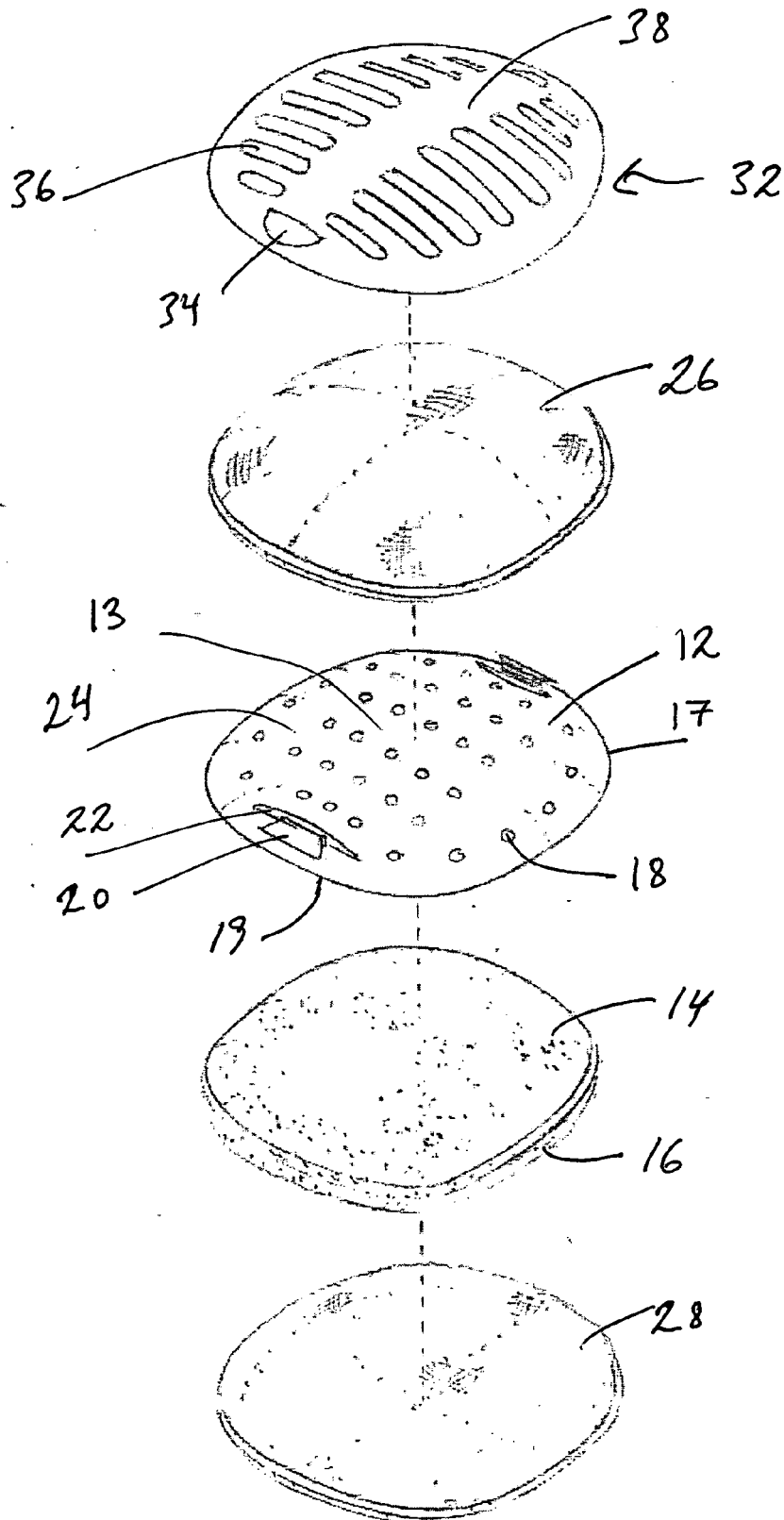
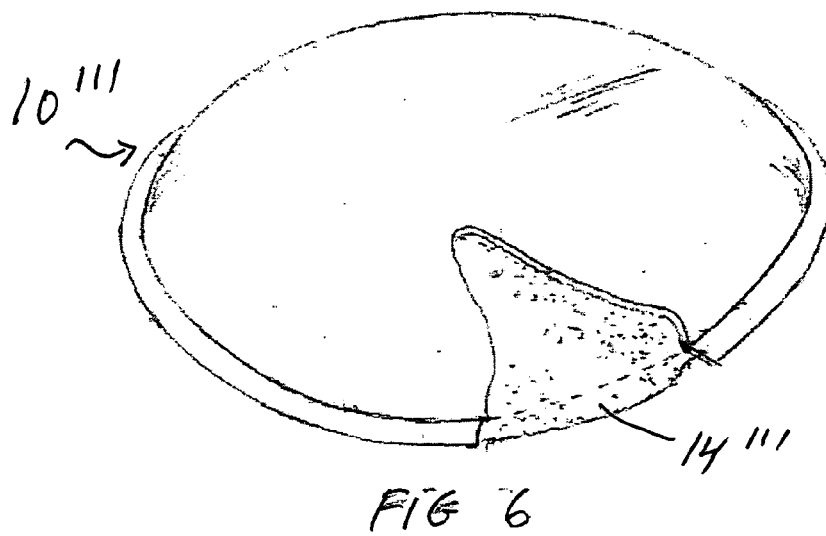
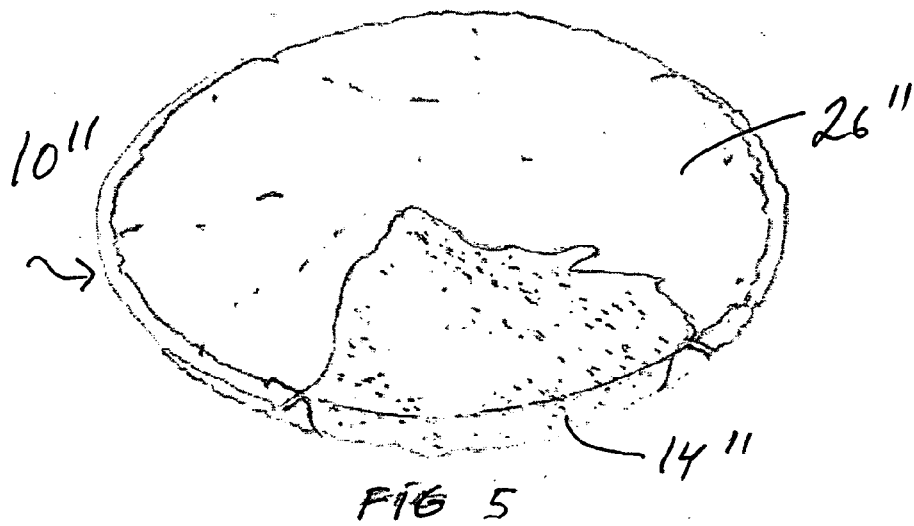
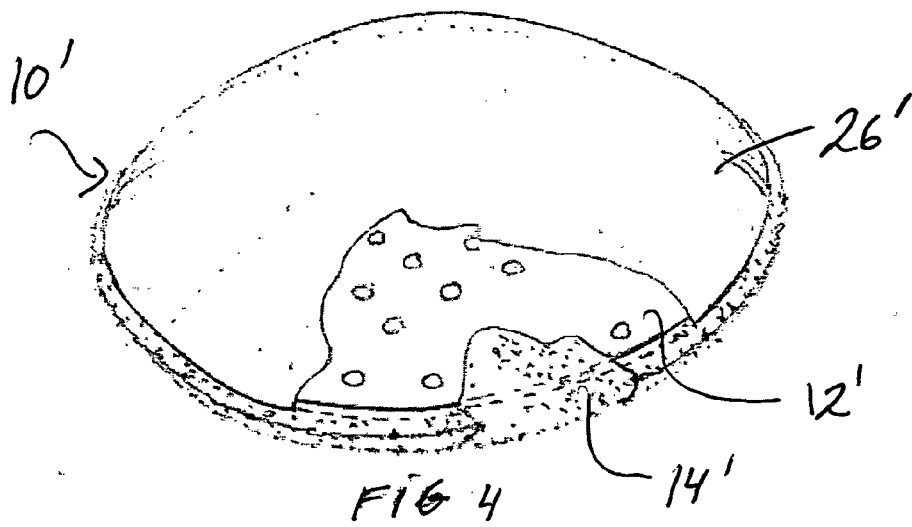
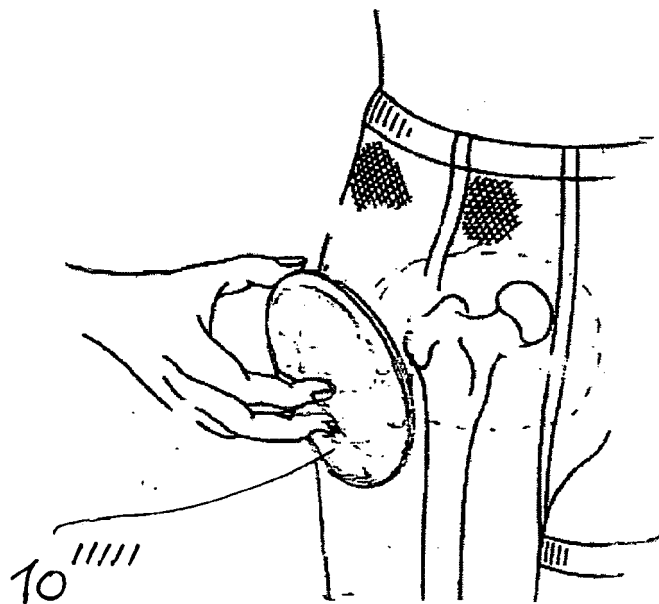
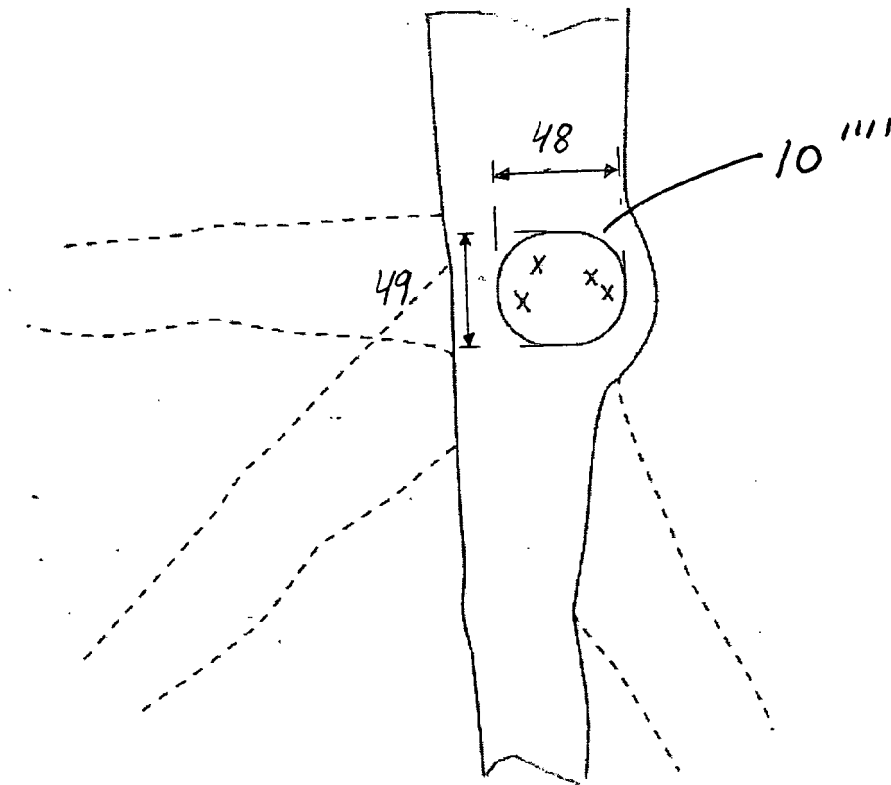
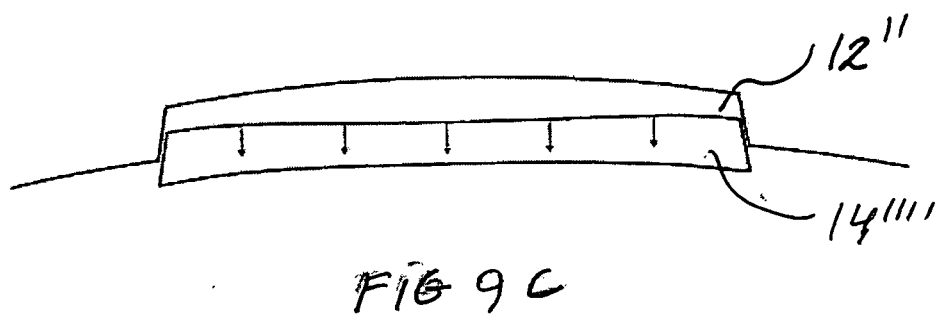
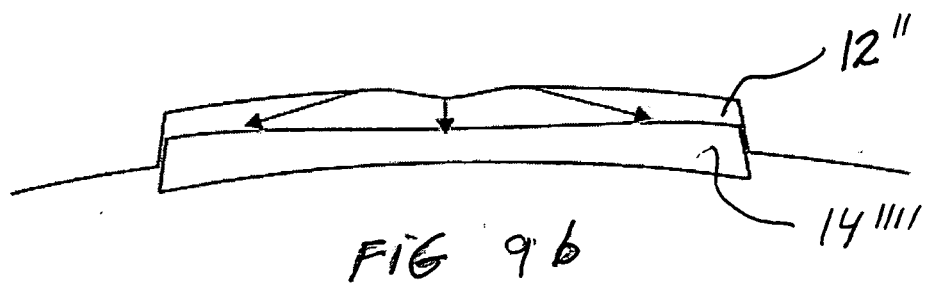
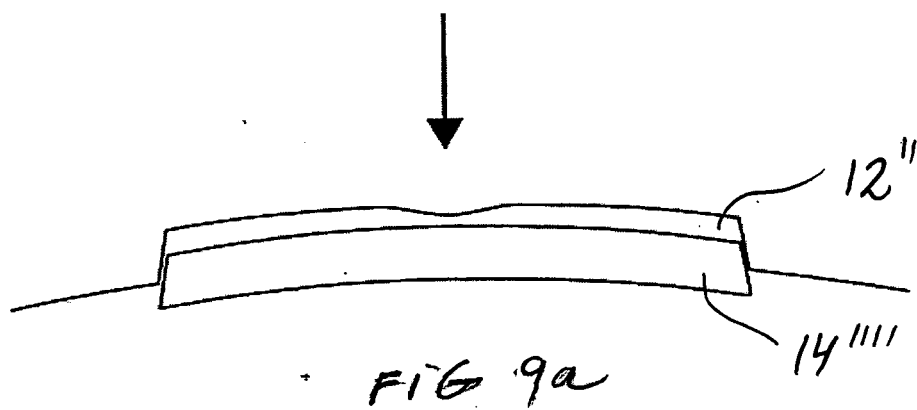


FIG 3









European Patent
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Application Number
EP 05 38 8089

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