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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
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Additional inventors are being named on the _____ separately numbered sheets attached hereto.

TITLE OF THE INVENTION (500 characters max):

HELMET OMNI-DIRECTIONAL ENERGY MANAGEMENT SYSTEM

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☐ The address corresponding to Customer Number: 68173

OR

☐ Firm or Individual Name

Address

City State Zip

Country Telephone Email

ENCLOSED APPLICATION PARTS (check all that apply)

☒ Application Data Sheet. See 37 CFR 1.76 ☐ CD(s), Number of CDs _____

☒ Drawing(s) Number of Sheets 3 ☐ Other (specify) _____

☒ Specification (e.g. description of the invention) Number of Pages 5

Fees Due: Filing Fee of \$220 (\$110 for small entity). If the specification and drawings exceed 100 sheets of paper, an application size fee is also due, which is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

METHOD OF PAYMENT OF THE FILING FEE AND APPLICATION SIZE FEE FOR THIS PROVISIONAL APPLICATION FOR PATENT

☐ Applicant claims small entity status. See 37 CFR 1.27.

☒ A check or money order made payable to the *Director of the United States Patent and Trademark Office* is enclosed to cover the filing fee and application size fee (if applicable). \$110

☐ Payment by credit card. Form PTO-2038 is attached.

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PROVISIONAL APPLICATION COVER SHEET
Page 2 of 2

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☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

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SIGNATURE _____

Date

2/9/11

TYPED or PRINTED NAME Jonathan Hangartner

REGISTRATION NO. 55244

(if appropriate)

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Docket Number: WEBER-1

Title: Helmet Omni-Directional Energy Management System

Field Of The Invention: The present invention relates to protection of the human head in the event of an accident where an individual is wearing a safety helmet. In particular, the present invention will reduce the likelihood of rotational brain injury, shearing of brain matter, linear compression, and / or concussion in accident situations.

Background of the invention: Action sports (e.g. skateboarding, snowboarding, BMX, downhill mountain biking, etc.), motorsports (e.g. off-road and on-road motorcycle riding and racing) and traditional contact sports (e.g. football and hockey) continue to grow at a significant rate throughout the world as each of these sports expand into wider participant demographics. While technology and sophisticated training regimes continue to improve the performance capabilities for such athletes/participants, the risk of injury also increases. To date, helmet protection devices have not experienced any material new technology that improves protection of the athlete's head and brain in the event of an accident. The current "state of the art" helmets are not keeping pace with the evolution of sports and the capabilities of athletes. At the same time, science is providing alarming data related to the negative effects from concussive impacts to an athlete's head. While concussions are at the forefront of concerns in each of the above-mentioned sporting activities, rotational brain injuries from the same concussive impacts are no less of a concern, and in fact are potentially more troublesome.

Rotational brain injury may occur when an accelerated application of force is applied to the helmet or head from at an angle greater or less than 90 degrees to a perpendicular plane drawn through the center of the brain. See Fig. 1.

Rotational brain injuries generated by angular acceleration forces in or around the individual's central brain area can be serious, long lasting, and potentially life threatening. Angular acceleration forces may become greater depending on the severity (force) of the impact, the degree of separation from 90 degrees, and the type of protective device that the individual may be wearing.

The exterior shells of helmets and the corresponding interior fit padding, foam padding, air filled bladders, or other means are tasked with managing forces applied to the helmet. When force applied to the helmet exceeds the capability of the combined resources of the helmet, including the interior padding, to manage the force, energy that is not absorbed by the helmet is transferred to the head and brain of the user. This may result in moderate concussion or severe brain injury, including a rotational brain injury depending on the type of impact energy, and the severity of the impact energy.

The desired function of helmets is to absorb and dissipate as much energy as possible, in the shortest amount of time possible, be it direct linear translational energy, or angular acceleration or deceleration energy in the event of any given accident situation, without transmitting that energy to the wearer's head form and brain. The goal of these helmets is to reduce or significantly diminish the risk of head and brain injury resulting from these various situations.

The present invention is intended to enhance modern helmet design for improved safety and the well being of athletes/participants in sporting activities in the event of any sort of impact to the head. The present invention addresses specifically the management, control, and reduction of these angular accelerational forces, while improving linear impact force performance within the helmet device during an accident.

Invention Description:

The present invention is an omni-directional impact energy management system for a helmet. The present invention seeks to significantly reduce the rotational and linear forces on the brain that are generated from impacts to a helmet. The following description is presented to enable any person skilled in the art to make and use the invention. For purposes of explanation, specific nomenclature is set forth to provide a thorough understanding of the present invention. Descriptions of specific embodiments or applications are provided only as examples. Various modifications to the embodiments will be readily apparent to those skilled in the art, and general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest possible scope consistent with the principles and features disclosed herein.

The present invention allows a controlled internal omni-directional displacement capability, including rotation, among the interior components of a hard shelled safety helmet. Generally, the present invention relates to a safety helmet comprising at least two layers housed within the hard exterior shell of the helmet. One of these layers, the inner liner, is in contact with the wearer's head. Another layer, the outer liner, is affixed to the hard outer shell of the helmet. One or more intermediate layers may be disposed between the inner and outer layers. These layers may be formed of any suitable material, including without limitation such materials commonly used in the industry such as expanded polystyrene (EPS).

In an exemplary embodiment of the invention, the outer surface of the inner liner is connected to the inner surface of the outer liner with components that will allow for controlled omni-directional relative displacement between the liners. Thus, the two liners are engaged with

each other such that they can displace relative to each other in response to angular forces from a glancing indirect or direct blow to the hard outer shell of the helmet. The engagement between the inner and outer liners allows for limited, controlled, omni-directional movement to reduce the transfer of forces and resulting acceleration originating from the hard outer shell of the helmet. The relative movement of the inner and outer layers is controlled via various means of suspension, dampening, and motion controlling components that engage the liners. Additional layers or partial layers may be inserted between the inner liner and the outer liner in such a way that would comprise various layers of components, with or without air gaps between them, that would allow for such controlled omni-directional relative displacement between one or more of the layers.

In an exemplary embodiment, two energy-absorbing liners are engaged within one another forming an assembly with complete omni-directional orbital capability established within specific definite range of movement margins. The liners may be multi or single-density EPS liners or may be comprised of any other suitable materials. The inner liner may be static and engaged directly by the individual's head through the use of a comfort liner and or fit pads common in all sporting helmets. Proper helmet restraint is managed by the chin-strap or neck security device commonplace on all helmets. Depending on the allowable degree of movement between the liners, a unique chin-strap or neck security device may be required.

As shown in Figure 2, which is a partial cross-section of an exemplary embodiment, the outer liner is disposed outside of the inner liner, but still interior to the helmet shell. The outer liner is affixed directly to the inside surface of the helmet shell as is commonplace in traditional helmet design. The traditional helmet shell may be manufactured from common materials such as fiber lay-up resin type materials, polycarbonate plastics, or other appropriate materials.

The inner and outer liners engage each other to form an internal sub-assembly by the use of a plurality of flexible or elastomeric structures referred to herein as flex bumpers or isolation dampers. In one exemplary embodiment shown in Fig. 2, the flex bumpers are generally circular with a circular concave recess and an outer flange. The flex bumpers fit between the inner liner and the outer liner such that the concave recess nests within a recess in the outer liner. A corresponding raised section of the inner liner nests within the concave recess. In another design embodiment the flex bumpers could connect to the inside surface of the outer hard shell directly.

A plurality of such flex bumpers may be provided at various points around the helmet. These flex bumpers provide the ability to control and tune the amount of rotational force that will cause displacement of the outer liner relative to the inner liner, and can be configured such that they will tend to cause the inner liner to return to its original position in reference to the

outer liner after the force is removed, functioning in a fashion similar to a ball and socket detent. The flex bumpers can be arranged in various modifications to the embodiments as will be readily apparent to those skilled in the art, and general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the invention.

An engineered limit (or stop) may be designed into and between the interior liners to prevent over-rotation or displacement between the interior liners due to the displacement of the exterior helmet shell assembly during an accident. In one exemplary embodiment the inner liner is provided with multiple flanges extending outward from the inner liner to act as rotational "stops" by impacting with the edge of the outer liner.

In other exemplary embodiments, an additional layer is inserted between the inner liner and outer liner. This layer, like the inner and outer liners, may be formed of EPS or any other suitable materials. In one exemplary embodiment shown in Fig. 3, lugs extending from the inner liner engage corresponding recesses in the middle layer, while lugs extending from the middle layer in turn engage corresponding recesses in the outer liner. These lugs and corresponding recesses can be designed to allow for a controlled amount of rotational movement between the liners and middle layer. Flex bumpers of various configurations can be placed between the liners and/or the middle layer to further dissipate energy. In one exemplary embodiment, the flex bumpers may be cylindrical in shape, and sized such that they engage recesses in the adjacent surfaces of the liners and middle layer, creating a space between those adjacent surfaces. The flex bumpers can flex, bend, and compress to absorb the energy of impacts from all directions, and allow the liners to move relative to the middle layer. In other exemplary embodiments, a similar system of lugs and flex bumpers can be implemented using only two layers, or using more than three layers. It will be readily understood by those of skill in the art that a wide range of potential configurations can be devised for the lugs and flex bumpers described herein. The lugs and flex bumpers may take on a wide range of shapes, sizes, materials, and specific physical properties. They may also be designed to engage different layers differently than shown herein.

Furthermore, by using different materials and configurations, it is possible to adjust or tune the protection provided by helmets that use this concept. The liners and any other layers can be formed from materials with distinct flex, compression, and crush characteristics, and the flex bumpers can be formed from various types of elastomers or other appropriate energy absorbing materials such as micro-cellular urethane. Thus, by tuning the density and stiffness of the flex bumpers, helmets can be designed to strategically manage impact energy based on the known range of common head weights expected to be present in any given helmet, by

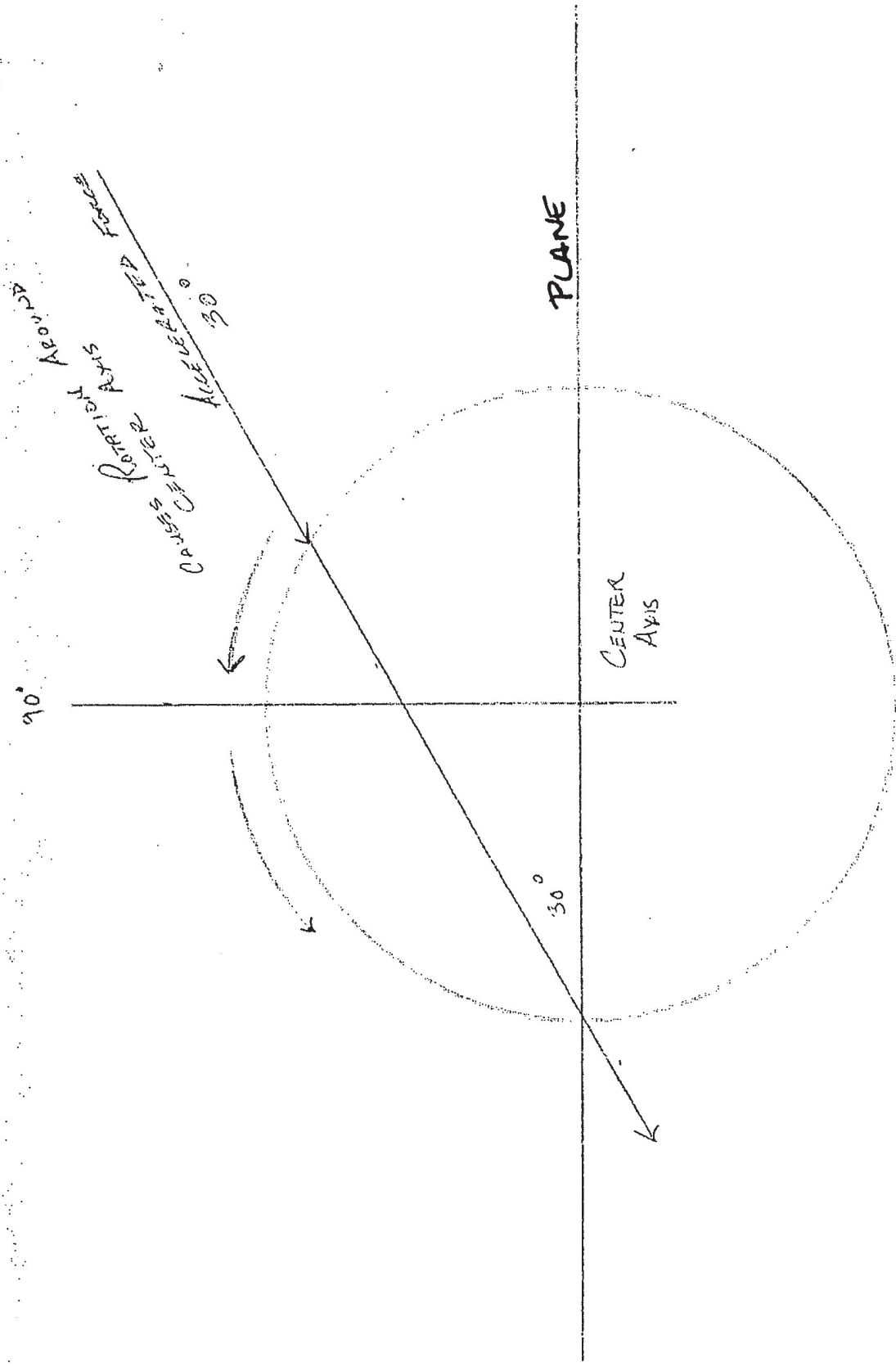
helmet size. For instance, the 12 year old youth has a smaller head and head weight than the 35 year old 200 lbs mature male.

These energy absorbing flex bumpers and lugs provide and support the ability for the component internal surfaces of the various liners and layers to be displaced and rotate in any direction necessary, independently of each other in the accident event where rotational demand forces are impacted upon the exterior of the helmet.

In summary, all helmets provide some level of protection in the event of linear impact as the interior fit pads and primary crush element yield. An important distinction between omni-direction absorption system and traditional energy management systems is the amount and the intent to allow for controlled and intended omni-directional displacement. As an example traditional EPS helmets have little to no capability to control or manage angular accelerational forces where the omni-directional energy management system will allow for significant rotational shearing and omni-directional displacement to absorb energy from all force vectors.

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WEBER

FIG. 1



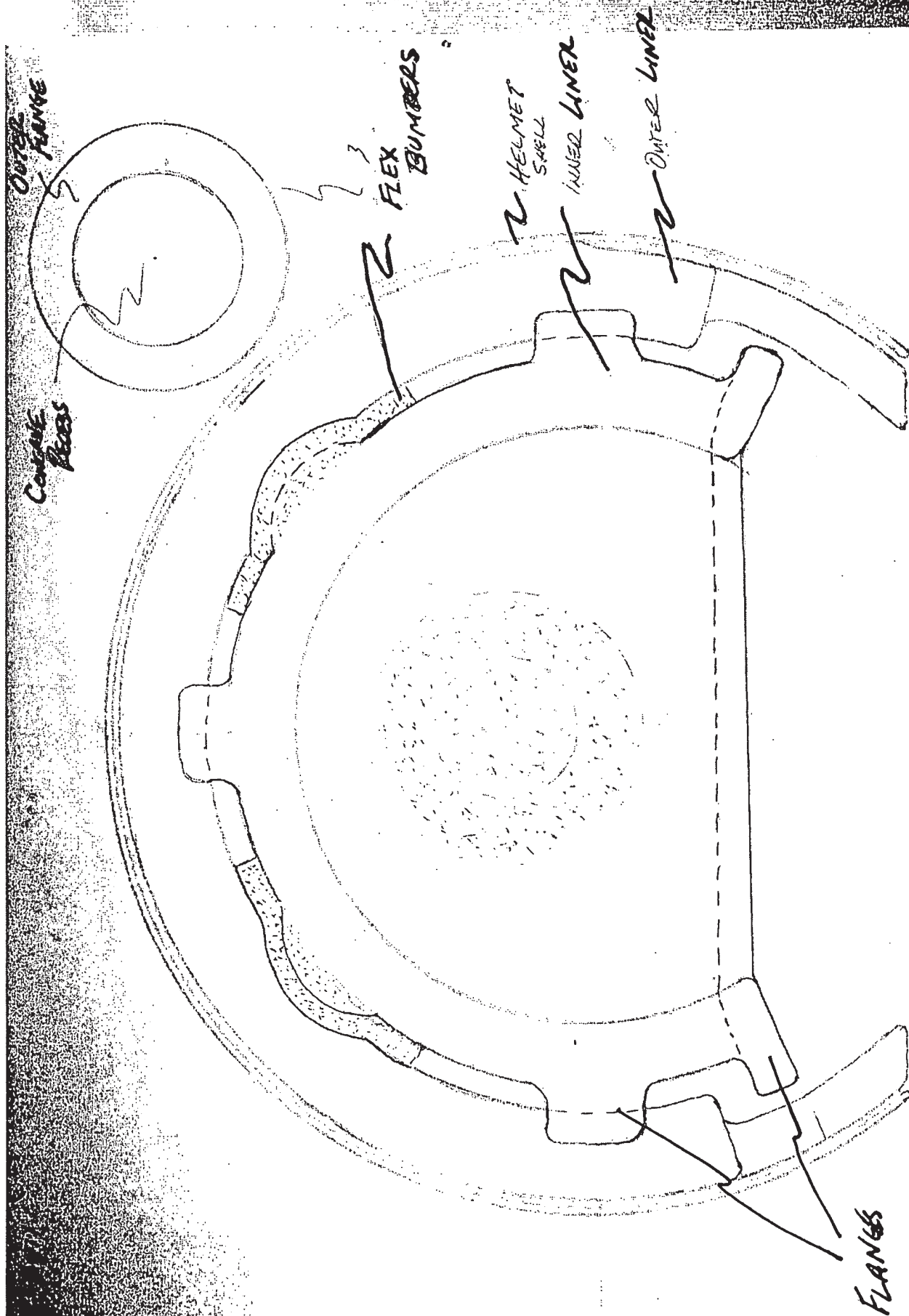
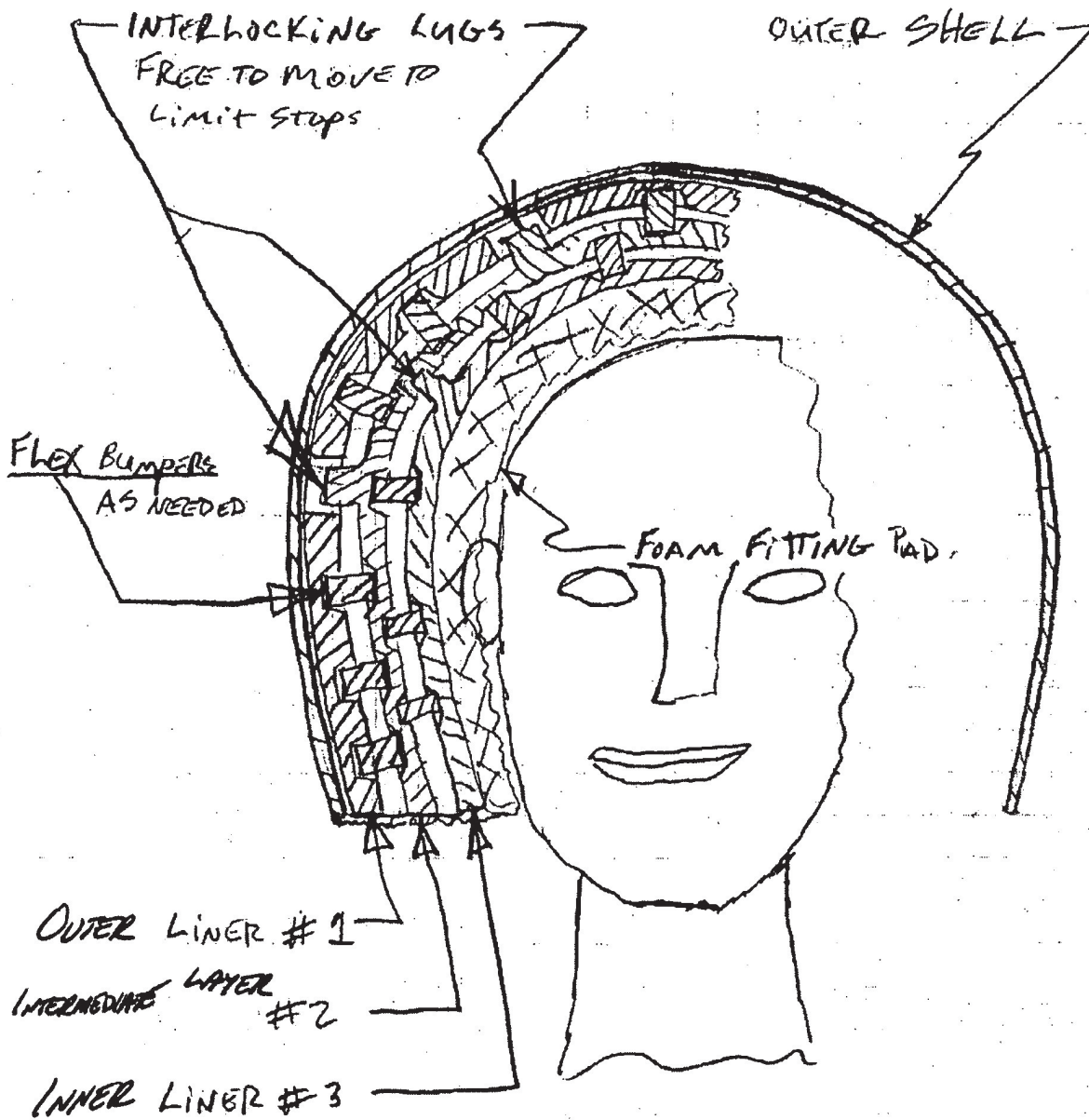


FIG. 2



SPD JAN. 31, 2011

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FIG. 3

Application Data Sheet

Application Information

Application Type:	Provisional
Subject Matter:	Utility
CD-ROM or CD-R?:	None
Title:	HELMET OMNI-DIRECTIONAL ENERGY MANAGEMENT SYSTEM
Attorney Docket No.:	WEBER-1
Request for Early Publication?:	No
Request for Non-Publication?:	No
Suggested Drawing Figure:	
Total Drawing Sheets:	3
Small Entity:	Yes
Petition Included?:	No
Secrecy Order in Patent Appl.?:	No

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Correspondence Customer Number: 68173

Representative Information

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Application Data Sheet

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Secrecy Order in Patent Appl.?:	No

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