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(54) **FOOTBALL SAFETY HELMET**

(71) Applicant: **Myron Dave Mayerovitch**, Orange, CA (US)

(72) Inventor: **Myron Dave Mayerovitch**, Orange, CA (US)

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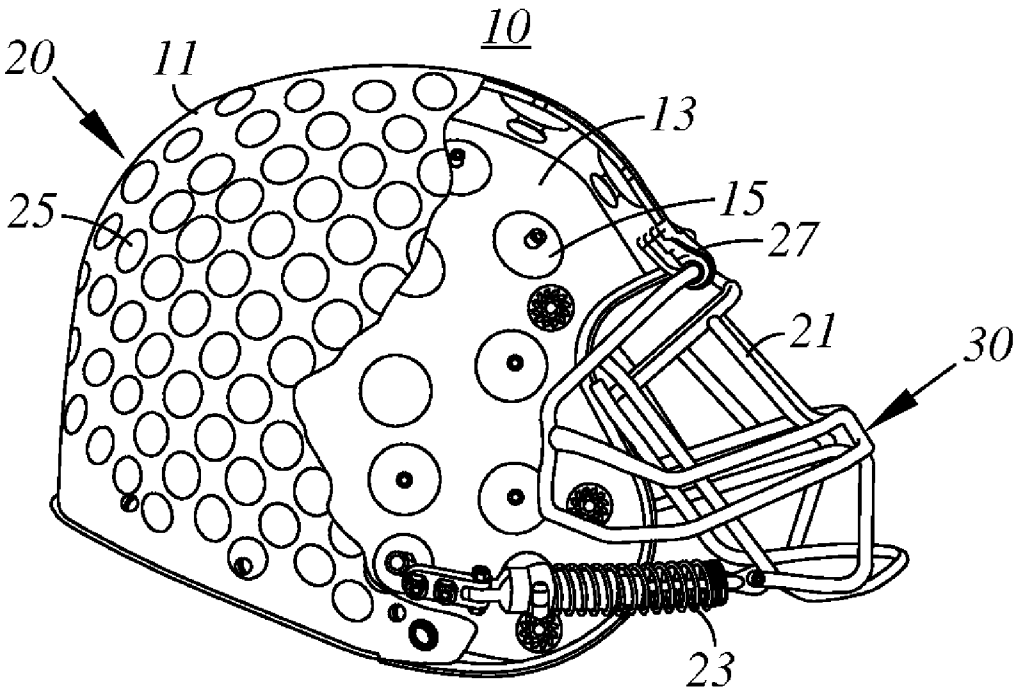
(57) **ABSTRACT**

A multilayer safety helmet assembly is provided comprising a helmet assembly including a helmet outer shell, a helmet inner shell, and an array of vibration dampeners disposed intermediate the outer shell and the inner shell. A resilient face guard/shock absorber assembly is further provided including a face guard and shock absorber assembly extending between the face guard and the helmet assembly. A head motion restraint assembly includes a first portion engaged to the helmet assembly and a second portion engageable to a shoulder pad(s) worn by a user.



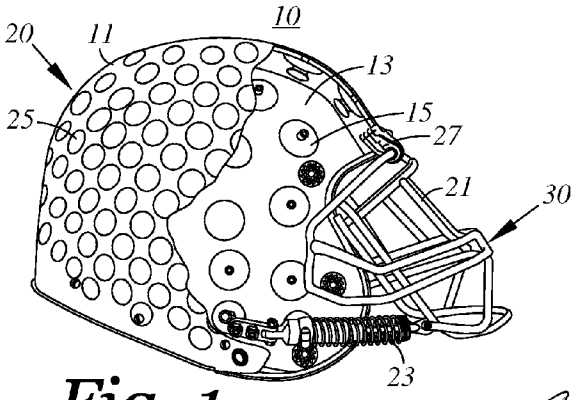


Fig. 1

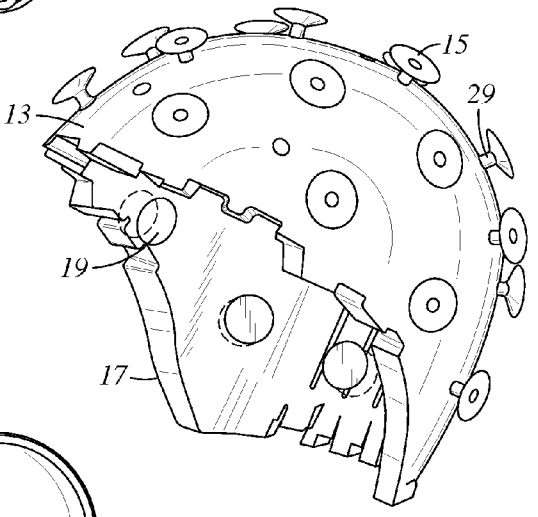


Fig. 2

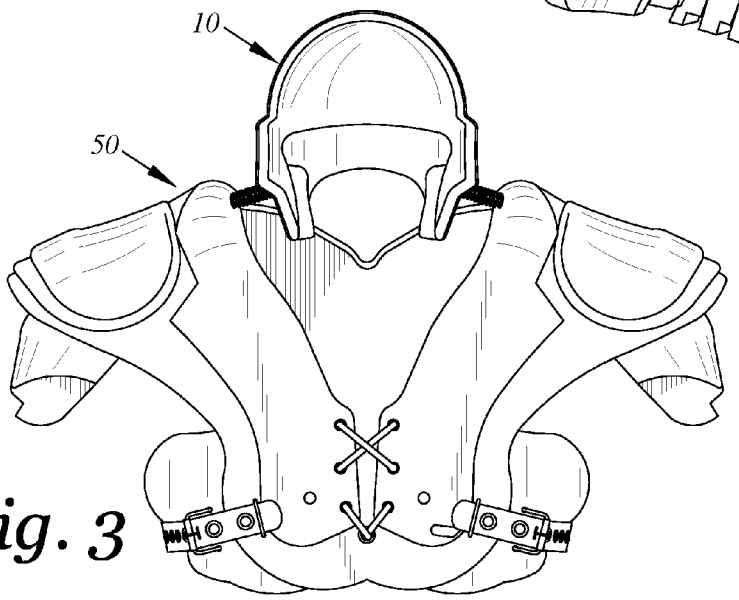


Fig. 3

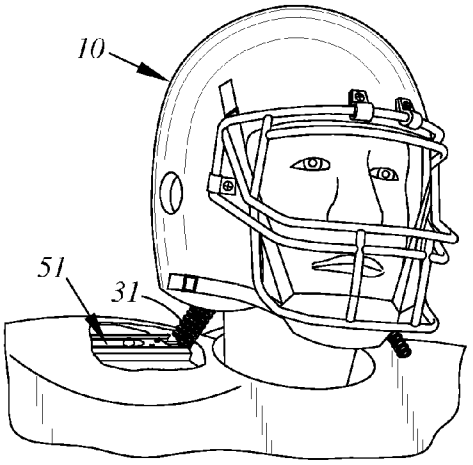


Fig. 4

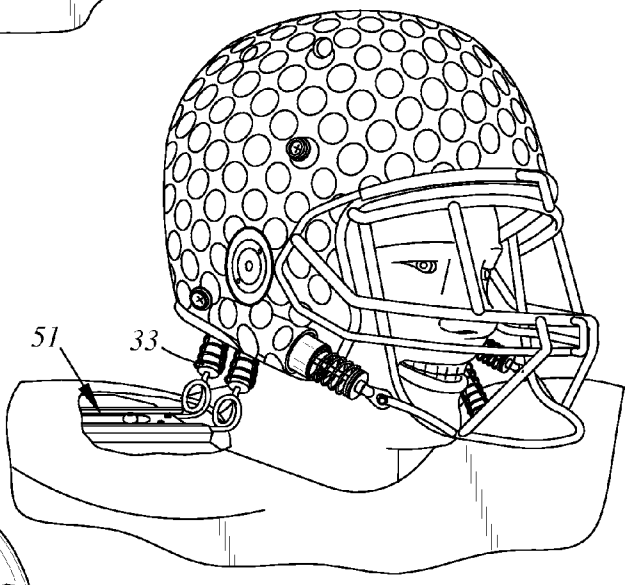


Fig. 5

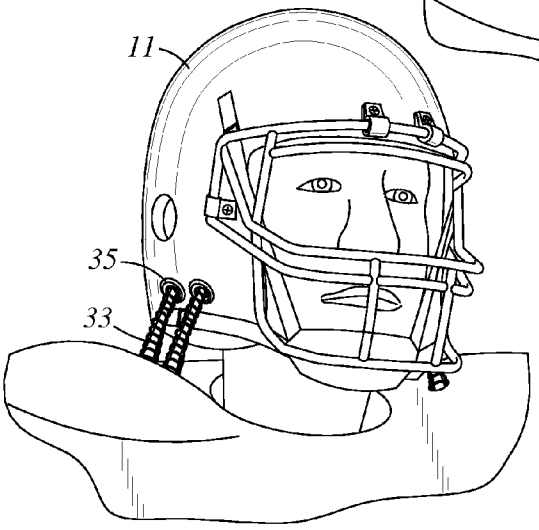


Fig. 6

Fig. 7

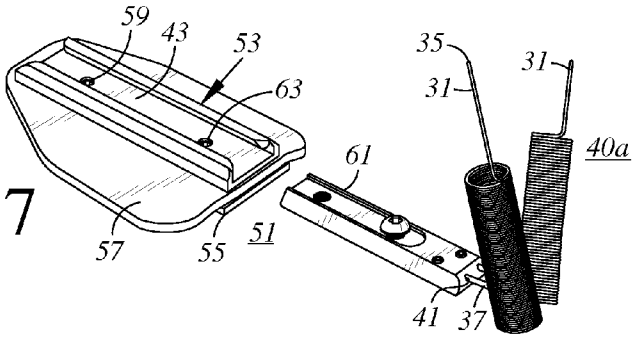


Fig. 8

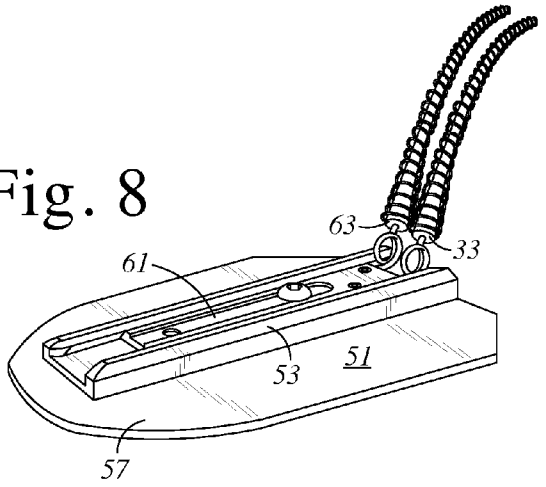
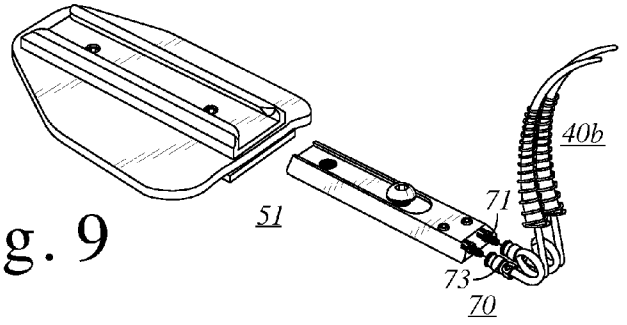


Fig. 9



FOOTBALL SAFETY HELMET

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application No. 61/886,420, filed Oct. 3, 2013, aspect of which are incorporated hereto.

STATEMENT RE: FEDERALLY SPONSORED RESEARCH/DEVELOPMENT

[0002] Not Applicable

BACKGROUND

[0003] Football is widely considered to be the most popular sport in America. By its nature, the sport is violent, involving jarring tackles and collisions which are a hallmark of the game.

[0004] Over the years, football safety equipment has evolved from the use of leather helmets and other apparel items that offer little protection, to bulky shoulder pads, bulky, padded helmets and various other accessories intended to protect players. However, due to the nature of the game, injuries continue to occur. Some injuries are immediately apparent and other injuries not immediately discernible, but may manifest themselves at the later times. Some injuries, e.g. concussions, may be cumulative to the point that the manifestation of the injury may not occur until well after the damage is done. Indeed, in many cases injuries can become more apparent long after a player has stopped playing a game and his/her body begins to show signs of wear and aging.

[0005] At earlier times, the potential for such injury was less well-known so that the need for better safety equipment was not realized. However, today the potential for various types of injuries from football is well established and known within the football community. Nonetheless, a player's love for the game, and the lure potential fame and fortune continue to draw many players and fans to the game.

[0006] In order to mitigate the inherent potential for injuries arising from playing football, various steps have been taken. Training regimes have been modified to mitigate injury and coaches have become more sensitized to the need to adopt safer practice procedures, and to spot potential injuries at earlier stage. Physical examinations of players have become more through and sensor systems have been proposed for incorporation into football equipment in order to better monitor the occurrence of concussion and other bone jarring impacts.

[0007] Football safety equipment has also evolved to utilize different materials, e.g. internal padding, to mitigate the transmission of shock forces from the helmet outer shell to the head of the user. However, the nature of the impact forces may widely vary and collisions may involve may multiply types of impacts. As such, no one feature is likely to provide protection in relation to the actual assortment and combination of impacts that football players are commonly exposed to.

[0008] Accordingly, there is a need for football equipment that provides protection against a variety of different impact forces, which can cause body portions to react and move into different directions and thereby cause injury to the player. Preferably such improved football equipment can provide protection in relation frontal impacts, such as hand slaps to the front of a helmet, as well as protection in relation to side impact forces that may cause a body portion to translate laterally in a manner that causes damage to the player.

[0009] The present invention is designed to provide an improved, multilayer safety helmet for use in football and other sports. The assembly is intended to provide protection in response to impacts on the helmet from different directions and different force levels. The helmet assembly is further designed to permit customization of the rigidity and reliance of the helmet safety portions, as well as facilitate use of the helmet in relation to players of different sizes and body shapes. Some exemplary embodiments of such a helmet are described below and illustrated in the accompanying drawings.

BRIEF SUMMARY

[0010] A multilayer safety helmet assembly is provided comprising a helmet assembly including a helmet outer shell, a helmet inner shell, and an array of vibration dampeners disposed intermediate the outer shell and the inner shell. A resilient face guard/shock absorber assembly is further provided including a face guard and shock absorber assembly extending between the face guard and the helmet assembly. A head motion restraint assembly includes a first portion engaged to the helmet assembly and a second portion engageable to a shoulder pad(s) worn by a user.

[0011] In one embodiment the outer shell is formed of Kevlar™/composite material and may include resilient surface material formed on an outer surface of the outer shell.

[0012] The vibration dampeners may be formed of the resilient, deformable material, to dissipate the transmission of shock forces from the helmet assembly outer shell to the helmet assembly inner shell. The vibration dampeners are preferably formed of carefully selected material(s) to regulate the stiffness of the helmet and/or the transmission of shock forces from the helmet assembly outer shell to the helmet assembly inner shell.

[0013] The shock absorber is preferably adjustable to provide for selective dampening of forces upon the face guard, to absorb and/or dissipate transmission of such shock forces from the face guard to the helmet assembly.

[0014] In one embodiment the face guard shock absorber is adjustable to the provide the low resistance to minor impact forces upon the face guard, thereby absorbing such minor impact forces without transmission to the helmet assembly. However, the shock absorber exhibits high resistance to higher impact forces upon the face guard, to protect the face of the user while still dissipating a substantial portion of the impact force. As such, the shock absorber may be constructed to mimic a tunable proportional integral differential (PID) circuit with a more muted response to lower impact forces and a more substantial response to higher impact forces.

[0015] The shock absorber may be implemented as a translatable hydraulic piston and/or one or more layers of deformable material(s), where in each layer has a different compression characteristics. In another embodiment the shock absorber may be implemented as a single layer or multilayer body of resilient material, wherein each layer of resilient material has different compressive characteristics to selectively respond to low impact and high impact forces. For example, the more highly compressible may be connected directly to the face guard with the denser, less compressible material is connected to the helmet assembly.

[0016] In one embodiment the shocker absorber is in engaged to the helmet assembly inner shell. However, the

shock absorber may alternately/additionally be connected to or though the helmet assembly outer shell.

[0017] A head motion restraint assembly is provided including a first portion engaged to the helmet assembly and a second portion engageable to the shoulder pad(s) worn by a user. The head motion restraint assembly may include different structural members to resist helmet motion in different ways. In one case, the head motion restraint assembly may include tension springs connecting the helmet assembly to the shoulder pad(s). In another case, tubular torsion members, or other twisted structured may be provided to connect the helmet assembly and the shoulder pads in such manner as to dampening the motion of the helmet relative to the shoulder pads, e.g. side to side motion, rotational motion, and/or frontward/rearward motion. In yet another embodiment, tubular torsion members may be used in combination with tension springs to provide multiple mechanical means for regulating the effect of impact forces on the helmet assembly.

[0018] Mechanical characteristics of the tension spring and/or torsion member may be selected in accordance with factors such as the body size and shape of a user, as well as the forces likely to be applied for a particular league or player position.

[0019] In another embodiment, elastic cords, e.g. bungee cords, may be used, alone or in combination with tension springs/tubular torsion members, to further control the head motion of the player. In each case, the goal is to define a construction of parameters that provide a balance between mitigating violent impact forces while still permitting a player the freedom of motion to turn his/her head in a different direction, e.g. to catch ball or see a tackler.

[0020] The safety helmet assembly may further comprise a shoulder pad engagement assembly having a first portion engageable to the shoulder pad(s) and a second portion engageable to the head motion restraint assembly.

[0021] The head motion restraint assembly may further include a quick connect/disconnect assembly engageable to the shoulder pad(s) assembly second portion, for easy connection/disconnection of the head motion restraint assembly from the shoulder pad engagement assembly.

[0022] The shoulder pad engagement assembly second portion may be laterally adjustable to laterally translate with respect to the shoulder pad engagement assembly first portion. As such, the connection between the safety helmet assembly and the shoulder pad(s) may be readily adjusted to accommodate different body sizes and different helmet sizes of users.

[0023] The head motion restraint assembly may utilize a plurality of torsion bar members, having a first portions engaged to the helmet assembly and second portions engageable to the shoulder pad engagement assembly second portion. In another embodiment, the head motion restraint assembly may include a plurality of tension springs, having a first portion engageable to the helmet assembly and a second portion engageable to the shoulder pad engagement assembly second portion. In another embodiment, the head motion restraint assembly may comprise an elastic cord(s), having a first portion engageable to the helmet assembly and second portion engageable to the shoulder pads or a belt disposed about a body portion of the user.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] These and other features and advantages of the various embodiments disclosed herein will be better understood with respect to the following description and drawings, in which like numbers refer to like parts throughout, and in which:

[0025] FIG. **1** illustrates one embodiment of a multilayer safety helmet assembly in accordance with some aspects of the present invention;

[0026] FIG. **2** illustrates the helmet assembly inner portion having a plurality of vibration dampeners extending therefrom;

[0027] FIG. **3** illustrates shoulder pads to which the safety helmet assembly may be connected to restrain head motion;

[0028] FIG. **4** illustrates one embodiment of the head motion restraint assembly connected to a shoulder pad engagement assembly;

[0029] FIG. **5** illustrates another embodiment of the invention with the head motion restraint assembly connected to the shoulder pad engagement assembly;

[0030] FIG. **6** illustrates a further embodiment of the invention wherein the head motion restraint assembly extends through the helmet assembly outer shell;

[0031] FIG. **7** illustrates one embodiment of the shoulder pad engagement assembly connected to one embodiment of the shoulder pad engagement assembly;

[0032] FIG. **8** illustrates another embodiment of the head motion restraint assembly connected to the shoulder pad engagement assembly; and

[0033] FIG. **9** illustrates an alternate embodiment of the shoulder pad engagement assembly including a quick connect/disconnect assembly.

DETAILED DESCRIPTION

[0034] The above description is given by way of example, and not limitation. Given the above disclosure, one skilled in the art could devise variations that are within the scope and spirit of the invention disclosed herein, including various ways of forming an outer shell/inner shell of the helmet assembly, different constructions of the vibration dampeners, different constructions of the shock absorber, and different constructions for securing the head motion restraint assembly to the helmet assembly and/or shoulder pad engagement assembly. Further, the various features of the embodiments disclosed herein can be used alone, or in varying combinations with each other and are not intended to be limited to the specific combination described herein. Thus, the scope of the claims is not to be limited by the illustrated embodiments.

[0035] Referring to the drawings, FIG. **1** illustrates an exemplary embodiment of a multilayer safety helmet assembly **10**. The assembly includes a helmet assembly **20**, a resilient face guard/shock absorber assembly **30** and a head motion restraint assembly **40**, shown more clearly at FIGS. **7** and **9**.

[0036] The helmet assembly **20** includes a helmet outer shell **11**, a helmet inner shell **13** and an array of vibration dampeners **15** disposed intermediate the outer shell **11** and the inner shell **13**.

[0037] The outer shell **11** may be formed of Kevlar™/composite material, and may include a resilient surface defining a plurality of resilient surface members **25**, arrayed upon the outer shell **11**.

[0038] Resilient face guard/shock absorber assembly **30** may be formed to include face guard **21** and shock absorber **23**, which connects face guard **21** to helmet inner shell **13**. The face guard **21** may also be connected to helmet assembly **10** by means of one or more connectors **27**.

[0039] The shock absorber **23** may be formed as a piston assembly which provides lower resistance to low impact forces on the face guard **30**, thereby absorbing such forces within the shock absorber. However, the shock absorber **23** may exhibit higher resistance to higher impact forces upon the face guard **30**. This serves to protect the face of the player from high impact forces on the face guard, while still dissipating a substantial portion of those forces within the shock absorber.

[0040] In an alternative embodiment, the functions of shock absorber **23** may be implemented by one or more layers of resilient material connecting the face guard **21** to the helmet assembly **10**. The layers may be selected to have different compressive characteristics. For example, a layer proximate the face guard **21** may be more compressible, allowing for absorption of low impact forces, while a layer proximate the helmet assembly **10** may be denser and less compressible.

[0041] As will be recognized by those skilled in the art, the characteristic features of shock absorber **23** or a multilayer material may be designed to implement a proportional integral differential circuit (PID) which functions to mute responses to lower impact forces, while providing a more substantial resistant to higher impact forces, thereby stabilizing the head of the user consistent with protection in relation to high impact forces.

[0042] FIG. **2** further illustrates the helmet assembly inner shell **13** and the array of vibration dampeners **15**. As it will be apparent to those skilled in the art, the vibration dampeners **15** may be constructed to include resilient tubular members **29** extending between the inner shell **13** and the outer shell **11**. The tubular members **29** may be formed of materials selected to regulate the transmission of shock forces from the helmet assembly outer shell **11** to the helmet assembly inner shell **13**. The tubular members **29** may be deformable in response to applied impacted forces on the helmet assembly **10**, to mitigate the transmission of shock forces from the helmet assembly outer shell **11** to the helmet assembly inner shell **13**.

[0043] It is anticipated that the array of vibrations dampeners **15** may include dampeners having different dampening characteristics in different areas, to provide stiffness in areas of greatness concern while allowing more resiliency in other areas.

[0044] Helmet assembly inner shell **13** may also be provided with inner padding **17** formed around the inner surface of the inner shell **13**. Additional padding members **19** may also be provided on the padding **17** to provide regions with additional protection and comfort.

[0045] FIG. **3** illustrates an exemplary shoulder pads(s) **50** which may be connected to helmet assembly **10**, as described in more detail below.

[0046] FIG. **4** illustrates a shoulder pad engagement assembly **51**, described further below, which facilitates connection of the head motion restraint assembly to the shoulder pads. FIG. **4** illustrates one embodiment wherein the head motion restraint assembly is implemented using tension springs **31**.

[0047] FIG. **5** illustrates another embodiment of the invention wherein the head motion restraint assembly is implemented using tubular torsion members **33**.

[0048] FIG. **6** illustrates an embodiment wherein the tubular members **33** of the head motion restraint assembly passes through the aperture **35** formed in the helmet assembly outer shell **11** to abut against and/or be connected to the inner shell **13**.

[0049] FIG. **7** illustrates in more detail the implementation of head motion restraint assembly **40***a*, including tension springs **31**. As shown, therein tension springs **31** include ends **35** which may be engageable to the helmet assembly and ends **37** engageable to apertures **41** of the slide bar **61**, which is receivable with in channel **43** of slide bar receiving member **53**. The slide bar receiving member **53** and base plate **55** are engageable by fasteners **59**, **63** to secure the shoulder pad engagement assembly **51** to shoulder pad portion **57**. As it will be apparent to those skilled in the art, slide bar **61** is translatable within the channel **43** such that springs **31** may translate laterally with respect to the helmet assembly in order to accommodate use of the head motion restraint assembly in conjunction with players of different body shapes and sizes.

[0050] FIG. **8** illustrates the use of the shoulder pad engagement assembly **51** in conjunction a head motion restraint assembly utilizing torsion member **33**, in combination with springs **63**.

[0051] FIG. **9** illustrates use of a quick connector assembly **70** to connect the head motion restraint assembly **40***b* to the shoulder pad engagement assembly **51**. As shown therein, the quick connect/disconnect assembly **70** includes male portions **71** and female portions **73** which may be easily connected and disconnected to facilitate disconnection of the head motion restraint assembly and removable of the helmet assembly from the head of the user.

What is claimed is:

1. A multilayer safety helmet assembly comprising:

a) a helmet assembly including a helmet outer shell, a helmet inner shell and an array of vibration dampeners disposed intermediate the outer shell and the inner shell;

b) a resilient face guard/shock absorber assembly including a face guard and a shock absorber extending between the face guard and the helmet assembly; and

c) a head motion restraint assembly including a first portion engaged to the helmet assembly and a second portion engageable to a shoulder pad(s) worn by a user.

2. The safety helmet assembly as recited in claim **1** wherein the outer shell is formed of Kevlar/compo site material.

3. The safety helmet assembly as recited in claim **1** wherein the helmet assembly outer shell comprises resilient surface material formed on an outer surface of the outer shell.

4. The safety helmet assembly as recited in claim **1** wherein the vibration dampeners are formed of materials selected to regulate transmission of shock forces from the helmet assembly outer shell to the helmet assembly inner shell.

5. The safety helmet assembly as recited in claim **4** wherein the vibration dampeners are resiliently deformable to dissipate transmission of shock forces from the helmet assembly outer shell to the helmet assembly inner shell.

6. The safety helmet assembly as recited in claim **1** wherein the shock absorber is adjustable to provide a selective dampening of impact forces upon the face guard and to mitigate the communication of the impact forces upon the face guard to the helmet assembly.

7. The safety helmet assembly as recited in claim **6** wherein the face guard shock absorber assembly is adjustable to provide low resistance to minor impact forces upon the face guard.

8. The safety helmet assembly as recited in claim **6** wherein the face guard shock absorber assembly is adjustable to provide low resistance to low impact forces on the face guard and higher resistance to high impact forces upon the face guard.

9. The safety helmet assembly as recited in claim **8** wherein the shock absorber comprises a translatable hydraulic piston.

10. The safety helmet assembly as recited in claim **8** wherein the shock absorber is engaged to the helmet assembly inner shell.

11. The safety helmet assembly as recited in claim **1** further comprising a shoulder pad engagement assembly having a first portion engageable to the shoulder pad(s) and a second portion engageable to the head motion restraint assembly.

12. The safety helmet assembly as recited in claim **11** wherein the head motion restraint assembly includes a quick connect/disconnect assembly engageable to shoulder pad engagement assembly second portion, for connecting/disconnecting the head motion restraint assembly from the shoulder pad engagement assembly second portion.

13. The safety helmet assembly as recited in claim **12** wherein the shoulder pad engagement assembly second portion is adjustable to laterally translate with respect to the shoulder pad engagement assembly first portion.

14. The safety helmet assembly as recited in claim **13** wherein the head motion restraint assembly comprises a tubular torsion member having a torsion member first portion engaged to the helmet assembly and a torsion member second portion engageable to the shoulder pad engagement assembly second portion.

15. The safety helmet assembly as recited in claim **13** wherein the head motion restraint assembly comprises a tension spring having a tension spring first portion engaged to the helmet assembly and a tension spring second portion engageable to the shoulder pad engagement assembly second portion.

16. The safety helmet assembly as recited in claim **1** wherein the head motion restraint assembly comprises an elastic cord.

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