United States Patent [19]

Mirabella

[11] **3,714,668**

[45] **Feb. 6, 1973**

[54] **PROTECTIVE HELMET**

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[73] Assignee: **Angelica Corporation,** St. Louis, Mo.

[22] Filed: **Feb. 11, 1971**

[21] Appl. No.: **114,538**

[52] **U.S. Cl.** ..... **2/3 C**

[51] **Int. Cl.** **A42b 3/00**

[58] **Field of Search** 2/3, 5, 6, 9, 10

[56] **References Cited**

UNITED STATES PATENTS

2,861,271	11/1958	Lee et al.	2/3 R
3,025,525	3/1962	Larson	2/3 R
3,110,900	11/1963	Crowdes, Jr.	2/3 R
3,122,751	3/1964	Jordan	2/3 R
3,500,474	3/1970	Austin	2/3 R
3,513,482	5/1970	Holden	2/3 R

FOREIGN PATENTS OR APPLICATIONS

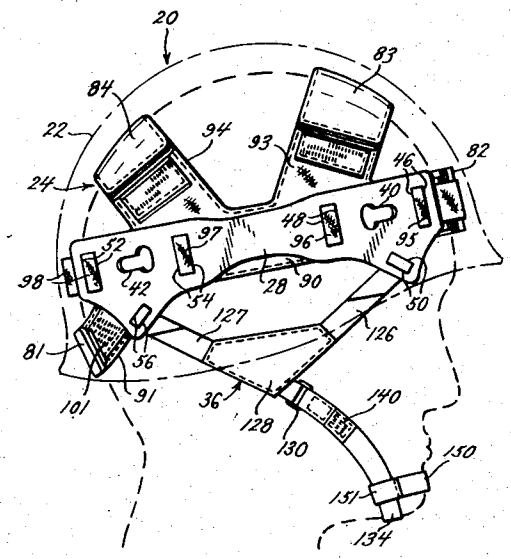
880,682	10/1961	Great Britain	2/3 R

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Attorney—Rogers, Exell, Eilers & Robbins

[57] **ABSTRACT**

This invention relates to a new and improved helmet comprising an outer shell and an advanced helmet suspension system supported therein. Also provided are adjusting means for fitting the suspension system to the exact head size required, including separate adjustments for the forehead, nape, and top of the head as well as for correctly positioning the suspension system within the shell.

18 Claims, 10 Drawing Figures



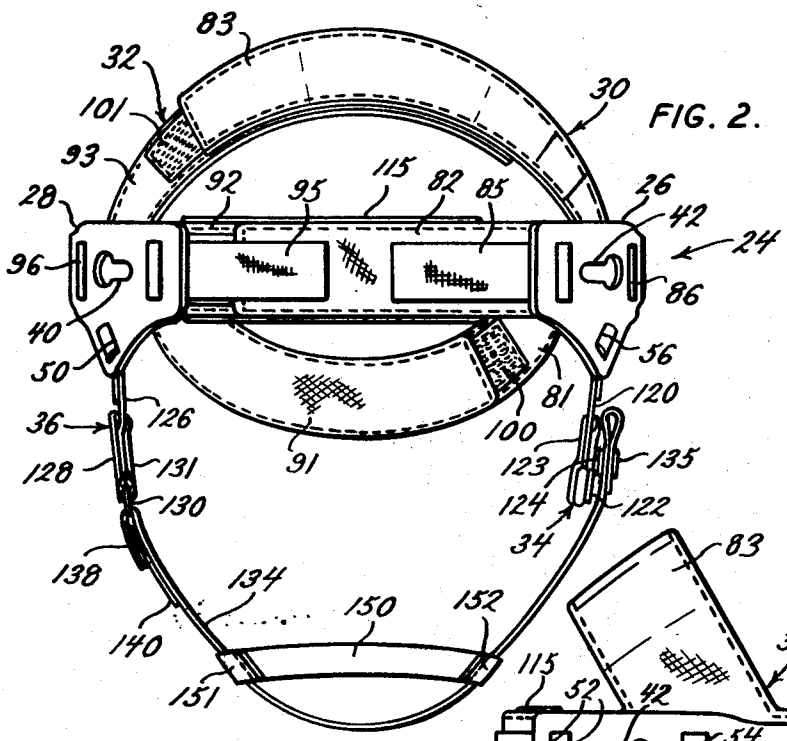


FIG. 2.

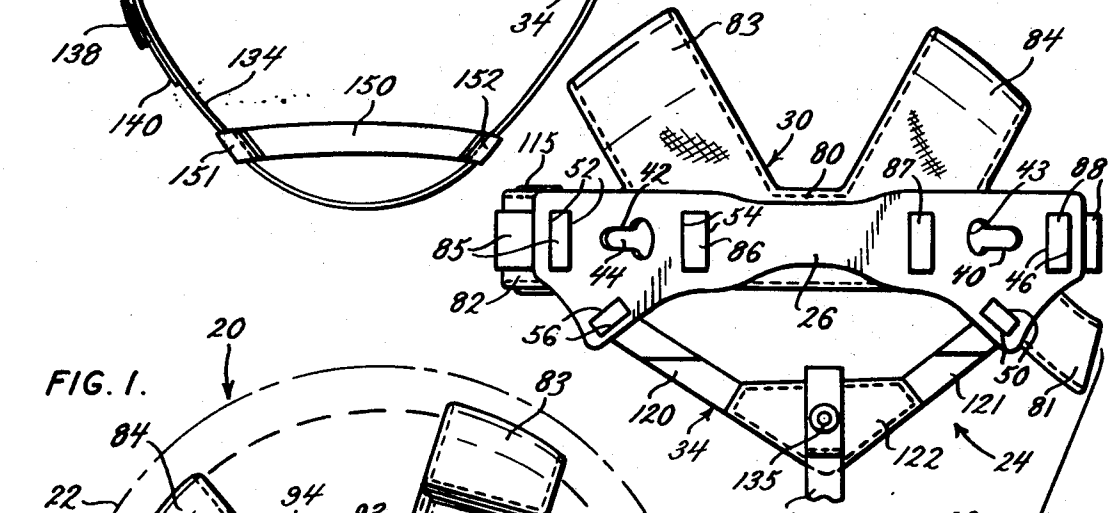
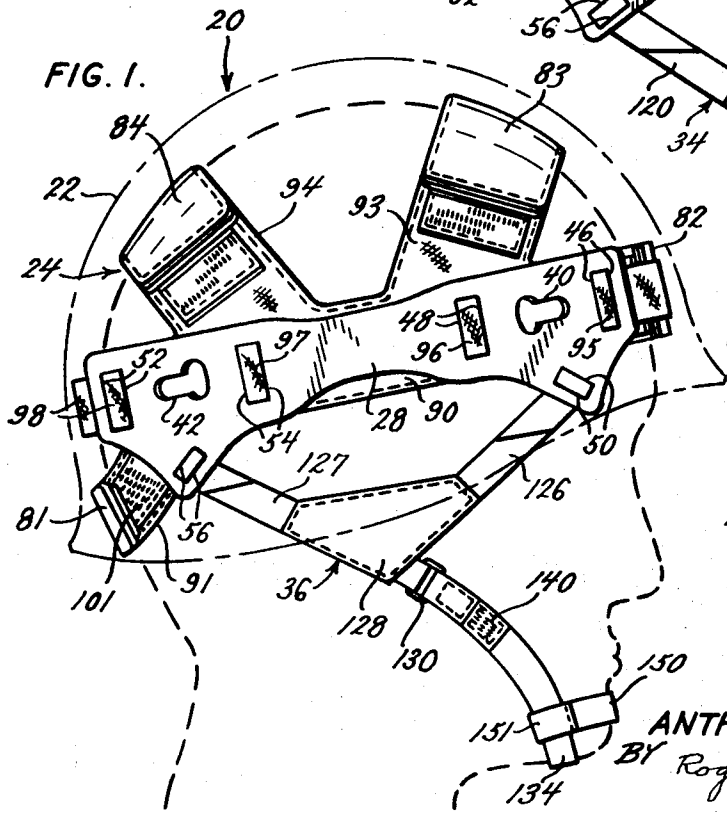


FIG. 1.



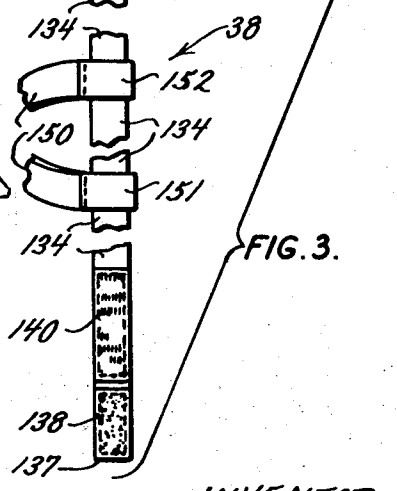
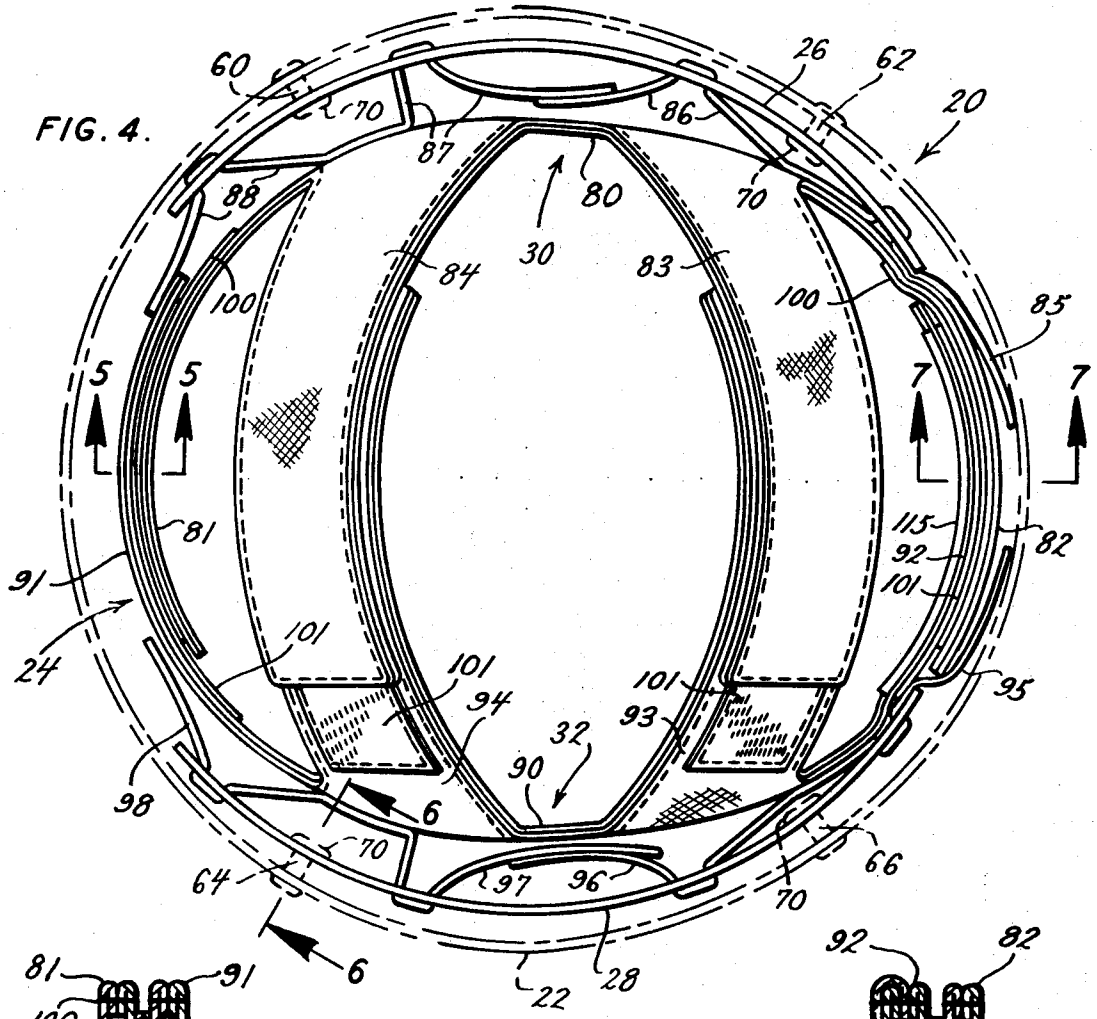


FIG. 3.

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FIG. 4.



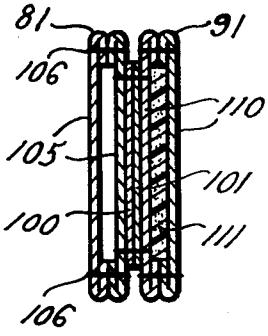


FIG. 5.

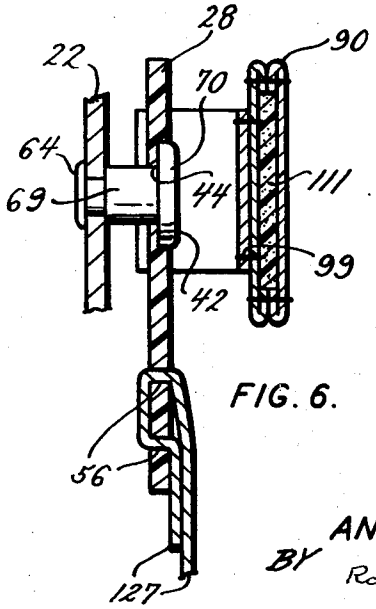


FIG. 6.

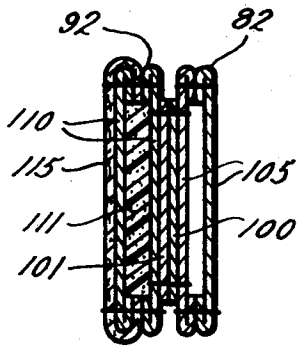


FIG. 7.

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FIG. 8.

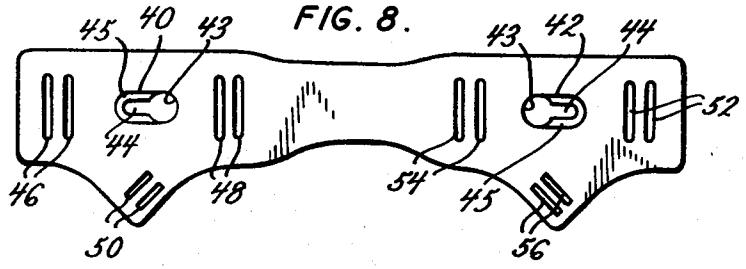


FIG. 9.

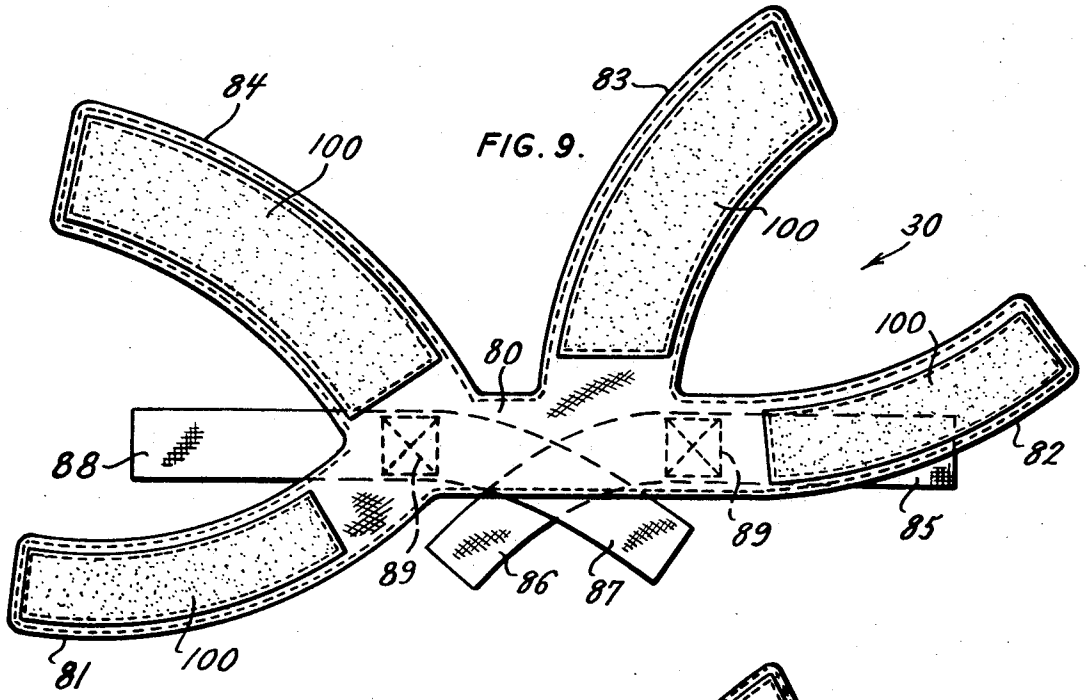
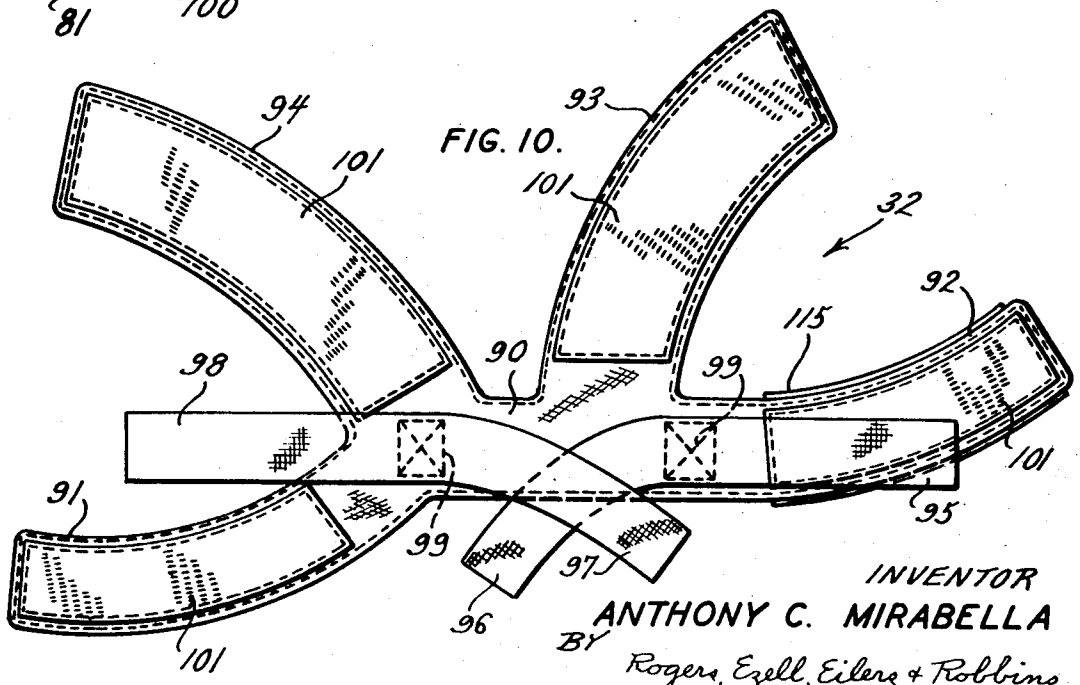


FIG. 10.



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PROTECTIVE HELMET

BACKGROUND OF THE INVENTION

The invention herein described was made in the course of or under a contract with the Department of the Army.

The primary function of any helmet suspension system is to act as a wearable support to which the protective helmet shell is mounted. In the early evolution of helmet designs, the helmet suspension systems consisted of bits of leather or cord laced together to provide some degree of adjustability. Recently, helmet suspension designs have become more specialized in an effort to optimize the overall performance of the helmet. The resultant designs fall into two basic categories: conformal suspension systems and sling suspension systems.

The conformal systems consist generally of a thick layer of foam or other shock-absorbing medium bonded directly to the inner surface of the helmet shell and molded or configured to fit snugly around the head. The disadvantages of the conformal systems are high cost resulting from the need for multiple basic shell sizes, difficulty in attaining exact fit, high weight, and poor helmet ventilation. The helmet of this invention is not of the conformal type.

The sling suspension system is the other basic category. With the sling system, the weight of the helmet shell is supported through attachment points around the circumference of the shell rather than through pads bonded to its inner surface as with the conformal system. Slings generally consist of a circumferential sweat band and over-the-head straps, webbing or netting.

The advantages of the sling systems are their size adjustability, light weight, good helmet ventilation, and mechanical flexibility. By mechanical flexibility is meant that the relatively simple design of the sling permits the selection of materials from either fabrics, plastics, or metals depending on the exact mechanical properties of the system desired. Conversely, with conformal systems, there are relatively few materials which can be used in their construction.

Unfortunately, there are certain disadvantages to the prior art helmet suspension systems which include inadequate adjustment provisions, improper location of suspension members, minimal contact area with the head, and inherent design deficiencies placing the helmet center of gravity too high.

The sling-type helmet suspension system of this invention obviates the problems associated with the prior art systems to provide a helmet design which offers vast improvements in the areas of sizing and fit, comfort, stability, and protection over the prior art.

SUMMARY OF THE INVENTION

The advanced helmet suspension system of this invention is of the sling type and includes generally a protective shell of suitable material, such as metal or plastic, supported on the head by a sling suspension assembly. The suspension assembly generally includes a right suspension assembly and a left suspension assembly, each adjustably supported by right and left side mounting brackets, respectively. Each mounting bracket has a base or circumferential strap made to extend from the side of the head forward over the forehead and rearward under the nape of the neck, and two substantially parallel straps extending from the base strap at the side of the head over the top of the head. The forehead, nape and top straps of the right and left suspension assemblies are aligned so that each of these straps of one side suspension assembly overlaps the corresponding strap of the other side suspension assembly with each having appropriate connection means for providing independent size adjustment for the forehead, nape and top of the head. The adjustable nape straps are curved slightly downward to provide a snug fit under the nape of the neck.

The combination of these independent strap adjustments together with the adjustable means for mounting the right and left suspension assemblies to the mounting brackets provide a total adjustment to fit the sling to any size head, as well as to position the sling within the helmet shell as desired by the wearer.

Other features include left and right chin strap yokes and a chin strap and cup assembly. These yokes are adjustably mounted to the left and right mounting brackets, respectively, to provide supports for the chin strap which is adjustably connected to the lower ends of the yokes.

This suspension assembly design includes several unique features. It permits the fabrication of the straps from a buildup of materials selected in accordance with the protection requirements of the helmet. Also the key to achieving stability in suspension system design is to make the diameter of the circumferential strap smaller than the maximum diameter of the head and to locate the plane of the circumferential strap below the plane of the maximum head diameter. This objective is achieved in this advanced helmet suspension system by incorporating an adjustable nape strap as an integral part of the circumferential strap allowing adjustment of the nape strap with the helmet in place.

These and other features of the invention are described in detail in the description to follow.

DESCRIPTION OF THE DRAWINGS:

FIG. 1 is a side elevational view of the helmet of this invention shown in the donned position with the protective shell shown in dashed lines to illustrate the sling suspension assembly therein;

FIG. 2 is a front elevational view of the sling suspension assembly;

FIG. 3 is a left-side elevational view of the sling suspension assembly of FIG. 1 with the right end of the chin strap disconnected;

FIG. 4 is a plan view of the helmet of FIG. 1 on an enlarged scale with the protective shell shown in dashed lines to illustrate the sling suspension assembly therein;

FIG. 5 is an enlarged view in section taken along the line 5—5 of FIG. 4;

FIG. 6 is an enlarged view in section taken along the line 6—6 of FIG. 4;

FIG. 7 is an enlarged view in section taken along the line 7—7 of FIG. 4;

FIG. 8 is an inside elevational view of the mounting bracket of this invention;

FIG. 9 is an inside elevational view of the left suspension assembly shown in its flattened position; and

FIG. 10 is an outside elevational view of the right suspension assembly shown in its flattened position.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT:

Referring primarily to FIGS. 1 through 4, there is shown the protective helmet 20 of this invention including generally a protective shell 22 of metal, plastic or other suitable material to provide a protective outer shield, and supporting the shell 22, a sling suspension assembly 24.

The shell 22 is supported by the sling suspension assembly 24 by means of left and right side mounting brackets 26 and 28, respectively, the sling assembly 24 generally including a left suspension assembly 30, a right suspension assembly 32, a left chin strap yoke 34, a right chin strap yoke 36 and a chin strap and cup assembly 38.

The left and right mounting brackets 26 and 28 are identical, and shaped generally as shown in FIGS. 1, 2, 3 and 8, each having keyhole slots 40 and 42 located generally at opposite ends of the bracket. Associated with each keyhole slot are a large aperture portion 43 and narrower slot portion 44 having a recess 45 to receive the head of a mounting pin. The slot portion 44 extends away from the large aperture portion 43 toward the closest end of the mounting bracket. Hence, associated with the keyhole slot 40 are pairs of elongated slots 46, 48 and 50, and associated with the keyhole slot 42 are pairs of elongated slots 52, 54 and 56. As will be described, the purpose of these slots is to adjustably support the remaining portions of the sling assembly.

As best shown in FIGS. 1, 4 and 6, pins 60 and 62 are rigidly secured to the wall of the helmet shell on the left side, and pins 64 and 66 are rigidly secured to the wall of the shell on the right side. Each of the pins 60, 62, 64 and 66 has a shank 69 and a head 70, the head 70 being small enough to pass through the large aperture portion 43 of the appropriate keyhole in the appropriate mounting bracket, but too large to be removed from the keyhole when its shank is located in the keyhole slot 44.

The keyholes 40 and 42 are spaced such that the distance between their large aperture portions 43 is equal to the distance between the mounting pins 60 and 62, or 64 and 66 with the mounting brackets held flat.

Holding the mounting brackets in the generally flat position, the mounting bracket 26 is mounted inside the left wall portion of the helmet shell 22 by placing the large aperture portions 43 of the keyholes 40 and 42 over the pins 60 and 62, respectively. Due to forces acting on the mounting brackets by the sling assembly 24, as will be hereinafter explained, the brackets 26 and 28 are caused to curve to the general contour of the head after they are released, in turn causing the heads 70 of the mounting pins to engage the recesses 45 of the keyhole slots 40 and 42 thereby securing the brackets to the helmet shell.

The mounting brackets 26 and 28 represent a unique feature of this invention in that they are fabricated from any suitable material, such as plastic; are identical and therefore interchangeable with their unique design requiring only a four-point mount to the helmet shell thus permitting instant installation and removal of the suspension system from the shell; and additionally through their elastic strength provide support for and maintain the shape of the assembled suspension system.

The left and right side suspension assemblies 30 and 32, respectively, are basically similar as shown in FIGS. 9 and 10. Referring to FIG. 9, the left side suspension assembly 30 generally includes a side strap portion 80 having extending therefrom a nape strap 81, a forehead strap 82, a foretop strap 83, and an aft top strap 84. The straps 81 through 84 are curved as shown in the drawing to conform to the contours of the head when the assembly 30 is assembled with the other components of the sling, as will be hereinafter described. Mounting straps 85, 86, 87 and 88 are affixed to the side strap portion 80 by any suitable means such as stitching 89. The mounting straps 85 through 88 are of any suitable material such as nylon web, and of a width approximately equal to the length of the slots 46, 48, 52 and 54 of the left side mounting bracket 26.

As best shown in FIG. 4, the mounting strap 85 is threaded through the slots 52, the mounting strap 86 is threaded through the slots 54, the mounting strap 87 is threaded through the slots 48, and the mounting strap 88 is threaded through the slots 46.

In like manner, the right side suspension assembly 32 generally includes a side strap portion 90 having extending therefrom a nape strap 91, a forehead strap 92, a foretop strap 93, and an aft top strap 94. The straps 91 through 94 are curved as shown in FIG. 11, just as are the straps 81 through 84 of the left side suspension assembly 30, to conform to the contour of the head. Also, like the left side assembly 30, the right side assembly 32 includes mounting straps 95, 96, 97 and 98 affixed to the side strap portion 90, by stitching 99 or other suitable means, for adjustably attaching the right side assembly 32 to the right side mounting bracket 28. Hence, the mounting strap 95 is threaded through the slots 46, the mounting strap 96 is threaded through the slots 48, the mounting strap 97 is threaded through the slots 54, and the mounting strap 98 is threaded through the slots 52.

As will be described in more detail, the threading of the mounting straps into the slots of the mounting brackets provides adjustment means for positioning the sling 24 within the helmet shell.

In this described embodiment, the straps 81 through 84 of the left side suspension assembly 30 are made to overlie the straps 91 through 94, respectively, of the right side suspension assembly 32, although, of course, the right side assembly could be made to overlie the left side assembly, if desired.

A pad 100 of pile, such as the pile used in Velcro hook and pile, is attached, such as by stitching, to substantially the full length of the inner surface of each of the straps 81 through 84 of the left side suspension assembly 30, and a pad 101 of tiny hooks, such as those used in Velcro hook and pile, is attached such as by stitching, to substantially the full length of the outer surface of each of the straps 91 through 94 of the right side suspension assembly 32. With the straps 81 through 84 of the left side suspension assembly 30 made to overlie the straps 91 through 94 of the right side suspension assembly 32, the hook pads 101 engage the pile pads 100 to securely attach the right and left assemblies together. The hook and pile provides nearly limitless adjustability between maximum and minimum head sizes. While other forms of connectors could be used, such as a series of snap connectors, none offer the

range of size adjustment and ease of connection that the hook and pile provides.

The left and right suspension assemblies are a unique feature of this invention. Because the sling is comprised of left and right members, each of which can be made to lie flat, they can be fabricated from a buildup of materials cut from a pattern. In this manner, the materials may be selected to fit the specific requirements of the sling. For example, as best shown in FIGS. 5 through 7, each of the straps **81** through **84** of the left side assembly **30** includes a double thickness of heavy woven fabric **105** held together by stitching **106**. The pile padding **100** is attached to the inside surface of the fabric **105** by appropriate stitching. Each of the straps **91** through **94** of the right side assembly **32** is also comprised of a double thickness of heavy woven fabric **110** with the hook pads sewn on the outside surfaces of the straps. Because the straps of the right side assembly **32** are next to the head, it may be preferable, depending on the shock requirements of the sling, to include between the fabric layers **110** a layer of padding **111** of foam or other suitable padding material. Also, as shown in FIG. 7, a leather sweat band **115** is sewn to the inside surface of the forehead strap **92**.

As can be seen, this pattern design offers great selectivity in the types of materials and number of layers used in fabricating the sling.

Referring to FIGS. **1**, **2** and **3**, the left side yoke **34** includes a fore-suspension strap **120** having one end threaded through the slots **56** of the left mounting bracket **26**, and an aft suspension strap **121** having one end threaded through the slots **50** of the left mounting bracket **26**. The other ends of the straps **120** and **121** are joined by a triangular piece **122** of heavy woven fabric or other suitable material. Because the inside surface of the triangular piece **122** contacts the face, a similar triangular piece **123** of leather or other perspiration-absorbing material is sewn to the inside of the piece **122** with the lower ends of the straps **120** and **121** sandwiched therebetween. A snap connector **124** is mounted in the triangular piece **122**.

Referring to FIG. **1**, the right side yoke **36** is very similar to the left side yoke **34**. The yoke **36** consists of a fore suspension strap **126** having one end threaded through the slots **50** of the right side mounting bracket **28**, and an aft suspension strap **127** having one end threaded through the slots **56** of the right side mounting bracket **28**. Like the straps **120** and **121** of the yoke **34**, the other ends of the straps **126** and **127** of the yoke **36** are joined by a triangular piece **128** of heavily woven fabric or other suitable material, except that the end of the suspension strap **127** extends slightly below and beyond the lower edge of the triangular piece **128** and is adapted to support a rectangular ring **130**. A similar triangular piece **131** of leather or other perspiration-absorbing material is sewn to the inside of the piece **128** with the lower ends of the straps **126** and **127** sandwiched therebetween.

As noted in connected with the mounting strap adjustments for the left and right side suspension assemblies **30** and **32**, suspension strap adjustments for the left and right yokes **34** and **36** afford great versatility in size adjustment.

A chin strap assembly **38** includes a strap **134** of nylon or other suitable material extending from the lower end of the left yoke **34** under the chin to the lower end of the right yoke **36**. A snap connector **135**, that mates with the snap connector **124** mounted on the triangular piece **122**, is mounted to the left end of the strip **134** for connection to the lower end of the left yoke **34**. At the right end **137** of the strap **134** is a small pile pad **138** sewn to the outer surface of the strap **134**. Spaced some distance from the pile pad **138**, a hook pad **140** is sewn to the exterior surface of the strap **134**.

With the left end of the strap **134** snapped to the lower end of the yoke **34**, the strap **134** is held in place under the chin by threading the end **137** outwardly through the ring **130**, pulling the strap **134** taut, and folding the end **137** back with the pile pad **138** engaging the appropriate portion of the hook pad **140**. The lengths of the pads **138** and **140** and the space therebetween are selected in accordance with the size adjustment requirements.

Also included in the chin strap assembly **38** is a strap **150** which extends across the front of the chin with its ends stitched to form loops **151** and **152** around the strap **134** on either side of the face. The loops **151** and **152** make it possible to adjust the strap **150** by sliding it along the strap **134**.

ASSEMBLY, SIZING AND DONNING PROCEDURES

As heretofore described, the left and right side suspension assemblies **30** and **32** are attached together preferably by means of hook and pile, such as Velcro hook and pile, to form the basic suspension unit. The unit attaches to each of the suspension mounting brackets **26** and **28** by means of the mounting straps **85**, **86**, **87**, **88**, **95**, **96**, **97** and **98**, the mounting brackets **26** and **28** in turn being mounted to the helmet shell **22** by means of keyhole slots **40** and **42** and mounting pins **60**, **62**, **64** and **66**. The chin strap yokes **34** and **36** attach to the mounting brackets **26** and **28** by means of the slots **50** and **56**; the chin strap assembly **38** attaches to the yoke assemblies by means of the snap connectors **124** and **135**, the rectangular ring **130** and the hook and pile **138** and **140** on the strap **134**.

Generally, the helmet height or offset is controlled by adjustment of the fore and aft top straps **83**, **84**, **93** and **94** made prior to installation of the suspension assembly in the shell; the sling circumference and fore and aft positioning of the sling within the helmet shell is controlled by appropriate positioning of the eight mounting straps **85** through **88** and **95** through **98** in the mounting bracket slots; circumferential tension is controlled by adjustment of the nape straps **81** and **91**; and the chin strap length and tension is controlled by the combined adjustment of the chin strap yokes **34** and **36** in the mounting bracket slots **50** and **56** and the strap **134** in the rectangular ring **130**.

INITIAL ASSEMBLY AND SIZING

To assemble and size the helmet of this invention, the wearer places the left side suspension assembly **30** on a table in front of him with the pile pads **100** facing up and the nape strap **81** extending to the left. The right side suspension assembly **32** is placed to the right of the left side assembly **30** with the leather sweat band **115** facing up and the nape strap **91** extending to the right. With the left and right suspension assemblies **30** and **32**

so positioned, the forehead strap **92** is attached to the forehead strap **82** by overlapping the hook pad **101** of the forehead strap **92** on the pile pad **100** of the forehead strap **82**. For most head sizes this overlapping should be such that the hook pad completely overlaps the pile pad. By grasping the nape strap **81** in the left hand and nape strap **91** in the right hand, the nape straps are brought together behind the head with the forehead pressed against the sweat band **115**. The circumference of the sling assembly is then adjusted to fit snugly around the head by adjusting the nape straps **81** and **91** just below the back of the head by means of the hook and pile pads. Normally, the height of the sling is correct where there is approximately a ¼ inch clearance between the ears and the sling. Next the foretop straps **83** and **93** and the aft top straps **84** and **94** are fastened together to fit snugly against the top of the head by means of the hook and pile pad.

With the head straps of the sling correctly adjusted, the sling is removed, the position of each strap marked, and the left and right suspension assemblies **30** and **32** disassembled to facilitate further assembly.

The procedure for attaching the left and right side suspension assemblies **30** and **32** to the mounting brackets **26** and **28** is basically identical so that only one need be explained in detail.

The right sling assembly **32** is placed on the table with the mounting straps **95** through **98** facing up and the nape strap **91** extending to the left. The mounting bracket **28** is held above the assembly **32** with the slots **46** directly above the strap **95**, the slots **48** above the strap **96**, the slots **54** above the strap **97** and the slots **52** above the strap **98**. Referring to FIG. **4**, the strap **95** is threaded through the slots **46** in the manner shown in the drawing so that the strap **95** is pulled flush with the mounting bracket **28**. Next the strap **96** is threaded through the slots **48** as shown in the drawing, so that it is very close to lying flat on the mounting bracket **28** with little or no slack. Next the strap **97** is threaded through the slots **54** allowing slack in accordance with the head size adjustment desired. The following table gives slack adjustment for either the strap **87** of the left sling assembly **30** or the strap **97** of the right sling assembly **32** for large, medium and small head sizes:

Head Size	Head Circumference	Strap **87** or **97** Position
Large	Greater than 23 in.	flush with mounting bracket
Medium	22–23 inches	½ inch slack
Small	Less than 22 in.	½ inch slack

Next the strap **98** is threaded through the slots **52** allowing slack in accordance with the head size adjustment desired. The following table gives slack adjustment for either the strap **88** of the left sling assembly **30** or the strap **98** of the right sling assembly **32** for large, medium and small head sizes:

Head Size	Head Circumference	Strap **88** or **98** Position
Large	Greater than 23 in.	1 ¼ inch slack
Medium	22–23 inches	½ inch slack
Small	Less than 22 in.	½ inch slack

As shown in FIG. **4**, the adjustment of the strap **98** causes the mounting bracket to curve.

The same procedure is followed for mounting the left side suspension assembly **30** with the strap **85** corresponding to the strap **95** and threaded through the slots **52**; the strap **86** corresponding to the strap **96** and threaded through the slots **54**; the strap **87** corresponding to the strap **97** and threaded through the slots **48**; and the strap **88** corresponding to the strap **98** and threaded through the slots **46**.

With the left suspension assembly **30** attached to the left mounting bracket **26** by means of the mounting straps **85** through **88**, and the right suspension assembly **32** attached to the right mounting bracket **28** by means of the mounting straps **95** through **98**, each of the strap **81** through **84** of the left assembly **30** is attached to its corresponding strap **91** through **94** of the right assembly **32** as previously marked. Next, the entire suspension assembly **24** is mounted in the helmet shell **22** by holding the left and right side mounting brackets **26** and **28** straight and placing the large aperture portions **43** of the keyhole slots **40** and **42** over the pins **60**, **62**, **66** and **64**. When the mounting brackets are released and allowed to curve as shown in FIG. **4**, the narrow slot portions **44** of the keyhole slots **40** and **42** slide over the shanks of the mounting pins, thereby holding the sling in the shell.

The assembly and sizing procedure heretofore described is meant by way of example only, it being understood that the forehead straps **82** and **92** need not completely overlap, but can be appropriately adjusted just as the other head straps to fit a particular size head. Additionally, the mounting straps can be adjusted to more exact tolerances than set forth in the above tables to fit any size head, and to position the sling assembly **24** up and down or fore and aft in the shell **22**.

DONNING PROCEDURE

To don the helmet **20**, the helmet is held upside down with the front of the helmet toward the body. The nape straps **81** and **91** are separated, the nape strap **81** held open with the thumb of the left hand while grasping the left side of the helmet, and the nape strap **91** held open with the thumb of the right hand while grasping the right side of the helmet. The helmet is then rotated over the head and pulled down on the head by means of the nape straps. The nape straps **81** and **91** are then fastened below the back of the head for a snug fit.

CHIN STRAP ASSEMBLY INSTALLATION AND ADJUSTMENT

The chin strap assembly **38** is optional, the helmet being perfectly functional for certain applications, such as protection from falling objects, without the chin strap assembly. However, the chin strap assembly is recommended where impact might jar the helmet from the head.

With the suspension assembly **24** removed from the shell **22**, the left yoke **34** is attached to the left mounting bracket **26** by threading the end of the strap **120** through the slots **56** and the end of the strap **121** through the slots **50**, and the yoke **36** is attached to the right mounting bracket **28** by threading the strap **126** through the slots **50** and the strap **127** through the slots **56**, as best shown in FIGS. **1** and **3**. The yokes should be threaded loosely at first until final adjustment is made of the chin strap assembly **38**. Next the snap con-

nector **135** of the chin strap assembly **38** is connected to the connector **124** on the left yoke **34**. The strap **134** is extended under the chin with the strap **150** positioned over the front of the chin. The end **137** is threaded through the rectangular ring and folded back with the pile pad **138** pressed on the hook pad **140** so that the chin strap assembly is held snugly in place. Exact adjustment of the chin strap is accomplished with the combined adjustment of the straps **120**, **121**, **126** and **127** of the yokes **34** and **36** and the strap **134** of the chin strap assembly **38**.

Various changes and modifications may be made within this invention as will be readily apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended hereto.

What is claimed is:

1. A protective helmet comprising a protective shell, a sling suspension assembly for supporting the shell on the head, the suspension assembly having a circumferential strap and top straps extending from the circumferential strap over the top of the head, left and right side mounting brackets, means associated with the left side of the circumferential strap for adjustably mounting the suspension assembly to the left side mounting bracket, means associated with the right side of the circumferential strap for adjustably mounting the suspension assembly to the right side mounting bracket, the mounting brackets being sufficiently flexible to conform to the general contour of the circumferential strap when mounted thereto, but sufficiently rigid to support and maintain the shape of the suspension assembly, and means for releasably mounting the left and right side mounting brackets to the left and right inside wall portions, respectively, of the shell so that the shell is suspended on the suspension assembly with the inner surface of the shell spaced from the outer surfaces of the suspension assembly.

2. The helmet of claim **1** wherein the left and right side mounting brackets are interchangeable.

3. The helmet of claim **1** wherein the means for adjustably mounting the suspension assembly to the left and right side mounting brackets includes a plurality of mounting straps attached and spaced along the left and right side portions of the circumferential strap, and for each mounting strap a pair of slots in the mounting bracket adjacent thereto through which the mounting strap is adjustably threaded.

4. The helmet of claim **3** including means associated with the mounting brackets for suspending the shell at four points around the circumference of the shell.

5. The helmet of claim **4** wherein the means for releasably mounting the left and right side mounting brackets to the shell includes a pair of keyhole slots in each mounting bracket, the keyhole slots being at substantially opposite ends of the bracket, each keyhole slot having a large aperture portion and a narrower slot portion extending away from the large aperture portion toward the nearest end of the bracket, a pair of spaced pins mounted to the interior surface at each side of the shell, each pin having a head that passes through the large aperture portion of the keyhole slot but not the narrower slot portion, the location and spacing of the pins being such that the heads of a pin pair pass through the large aperture portions of the associated keyhole pair with the mounting bracket held straight, but remain engaged in the narrower slot portions when the bracket is allowed to curve to the general contour of the circumferential strap, thereby providing a four-point quick release mount of the shell on the suspension assembly.

6. The helmet of claim **4** including a chin strap assembly having a strap extending under the chin, with means for supporting one end of the strap from one mounting bracket, and means for adjustably supporting its other end from the other mounting bracket.

7. The helmet of claim **6** wherein the last two named supporting means includes a yoke between each end of the chin strap and the corresponding mounting bracket.

8. A protective helmet comprising a protective shell, a sling suspension assembly for supporting the shell on the head, the sling suspension assembly including a left suspension assembly and a right suspension assembly, each having a side strap portion with a nape strap extending rearwardly therefrom, a forehead strap extending forwardly therefrom, and a plurality of top straps extending upwardly therefrom, mating connector means associated with each of the nape, forehead, and top straps for adjustably attaching each strap of the left suspension assembly to its corresponding strap of the right suspension assembly, and means for suspending the shell on the suspension assembly so that the inner surface of the shell is spaced from the outer surfaces of the suspension assembly.

9. The helmet of claim **8** wherein each of the left and right suspension assemblies are patterned from a build-up of flat sheets of material selected in accordance with the protection requirements of the helmet.

10. The helmet of claim **8** wherein the mating connector means associated with each of the nape, forehead and top straps are hook and pile pads to provide continuous and independent size adjustment over a wide range of sizes for each of the nape, forehead and top straps.

11. The helmet of claim **11** wherein each of the forehead, nape and top straps is curved to fit the contour of the head.

12. The helmet of claim **8** wherein the nape straps are curved downward to fit at the back of the head below the perimeter of maximum circumference of the head, the side straps, forehead straps, and nape straps of the left and right suspension assemblies combining to define a circumferential strap extending around the head, whereby the helmet can be first donned with only the nape straps separated, and then the nape straps adjustably attached in the back of the head, placing the circumferential strap below the head perimeter of maximum circumference.

13. The helmet of claim **8** including quick release means for suspending the shell on the suspension assembly, whereby the suspension assembly can be fitted to the head before the shell is suspended thereon.

14. The helmet of claim **13** including means for suspending the shell at four points spaced around the circumferential strap to provide a stable four-point suspension system.

15. The helmet of claim **8** wherein the means for suspending the shell on the suspension assembly includes means for adjusting the location of the entire suspension assembly in the shell.

16. The helmet of claim 8 including left and right side mounting brackets, means associated with the side strap portion of the left suspension assembly for adjustably mounting the left suspension assembly to the left side mounting bracket, means associated with the side strap portion of the right side suspension assembly for adjustably mounting the right suspension assembly to the right side mounting bracket, the mounting brackets being sufficiently flexible to conform to the general contour of the helmet shell when mounted therein, but sufficiently rigid to support and maintain the shape of the suspension assembly, and means for releasably mounting the left and right side mounting brackets in the left and right inside wall portions, respectively, of the shell so that the shell is suspended on the suspension assembly with the inner surface of the shell spaced from the outer surfaces of the suspension assembly.

17. The helmet of claim 16 including means associated with the mounting brackets for suspending the shell at four points around the circumference of the shell.

18. The helmet of claim 8 wherein the top straps are substantially parallel as they lay over the top of the head.

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