United States Patent

[11] 3,599,239

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[54] **PROTECTIVE HEADGEAR**
11 Claims, 18 Drawing Figs.

[52] **U.S. Cl.** ..... **2/3 R**
[51] **Int. Cl.** **A42b 3/00**
[50] **Field of Search** 2/3, 6

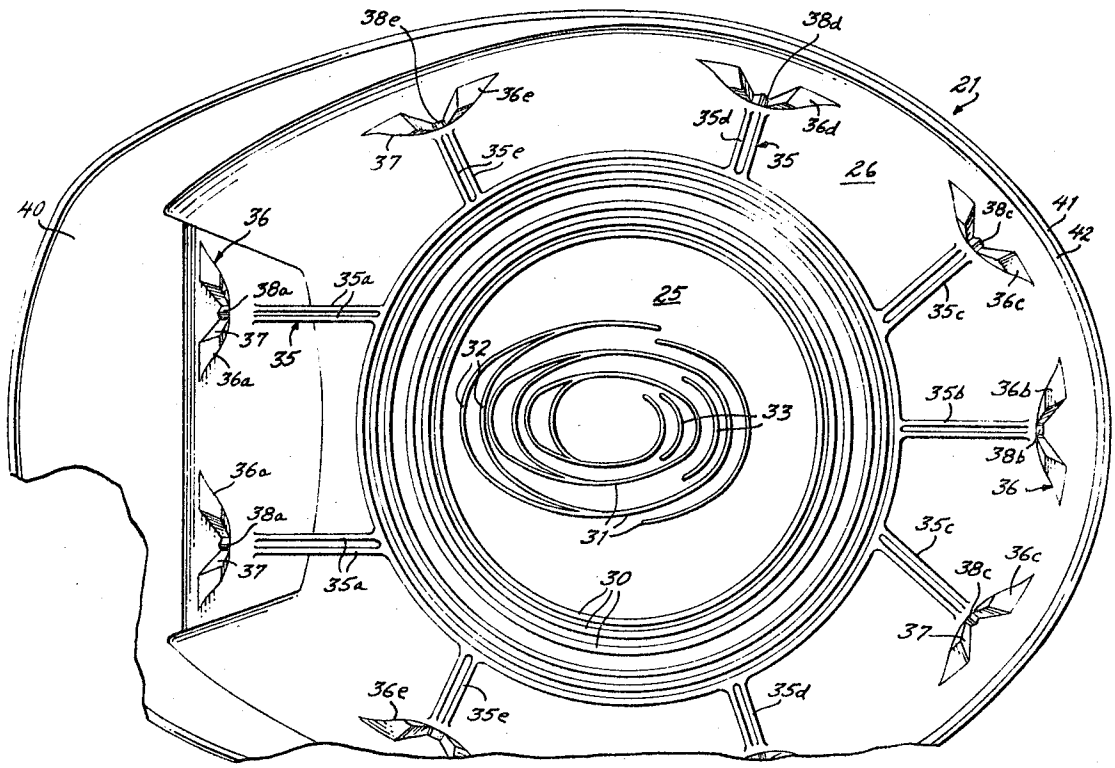
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ABSTRACT: An outer shell and a suspension construction for engagement with a wearer's head and supporting the shell in spaced relation thereto, the suspension being specifically configured by shape and thickness for directionally controlled distention under impact applied to the shell, and the shell being provided with resilient means by shape and thickness for obliquely deflecting an article impinging on the shell.



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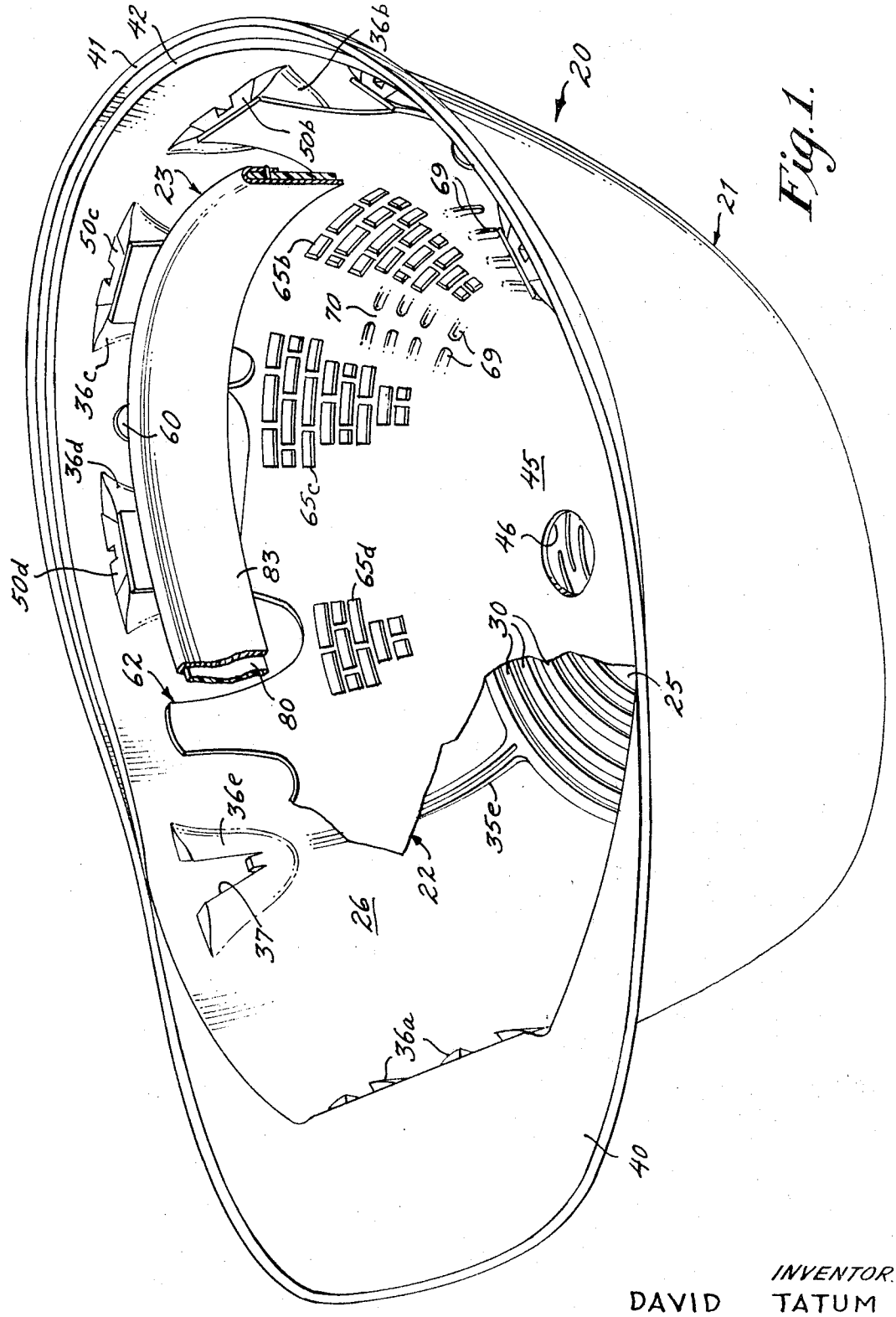
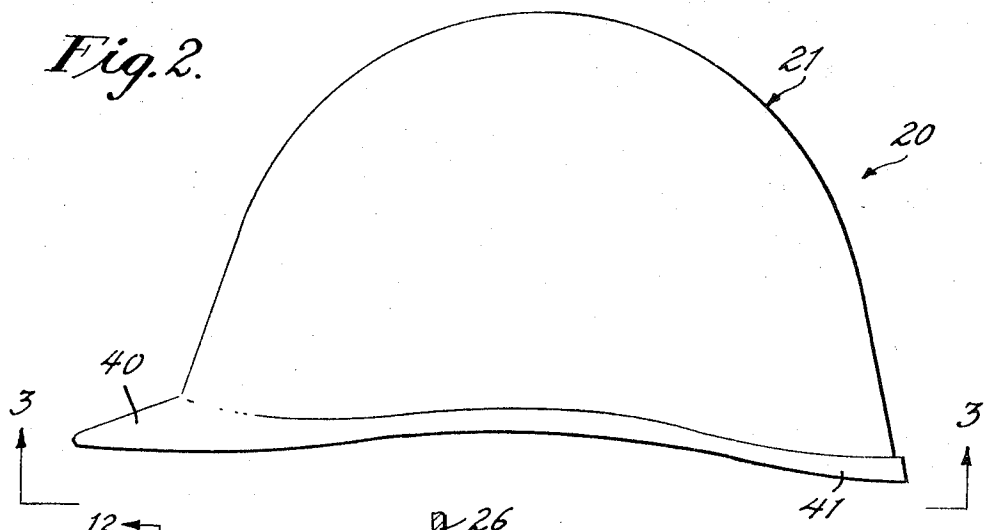


Fig. 1.

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Fig. 2.



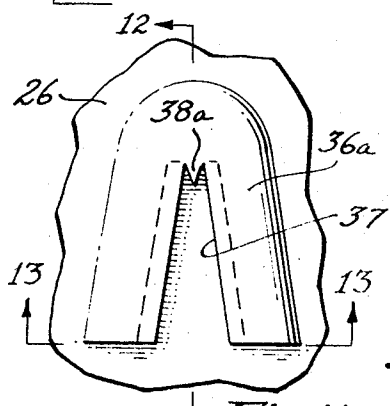


Fig. 11.

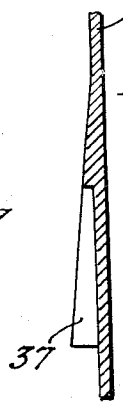


Fig. 12.

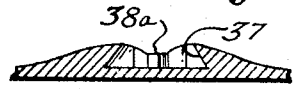


Fig. 13.

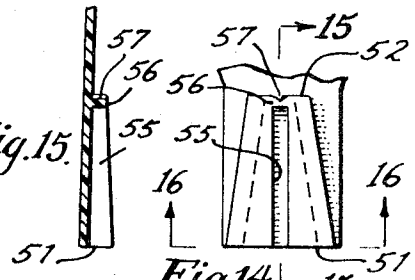


Fig. 15.

Fig. 14.

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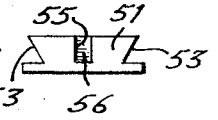


Fig. 16.

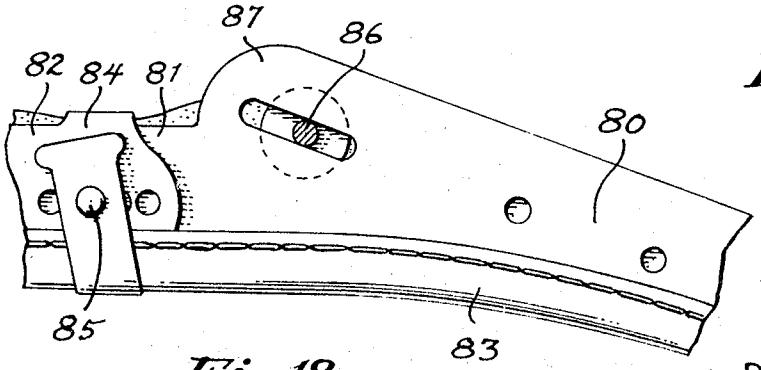


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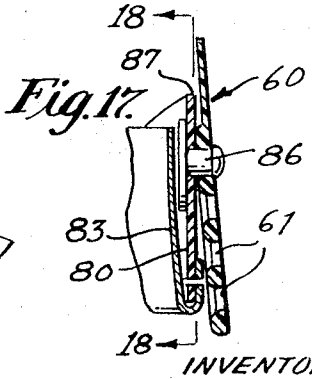
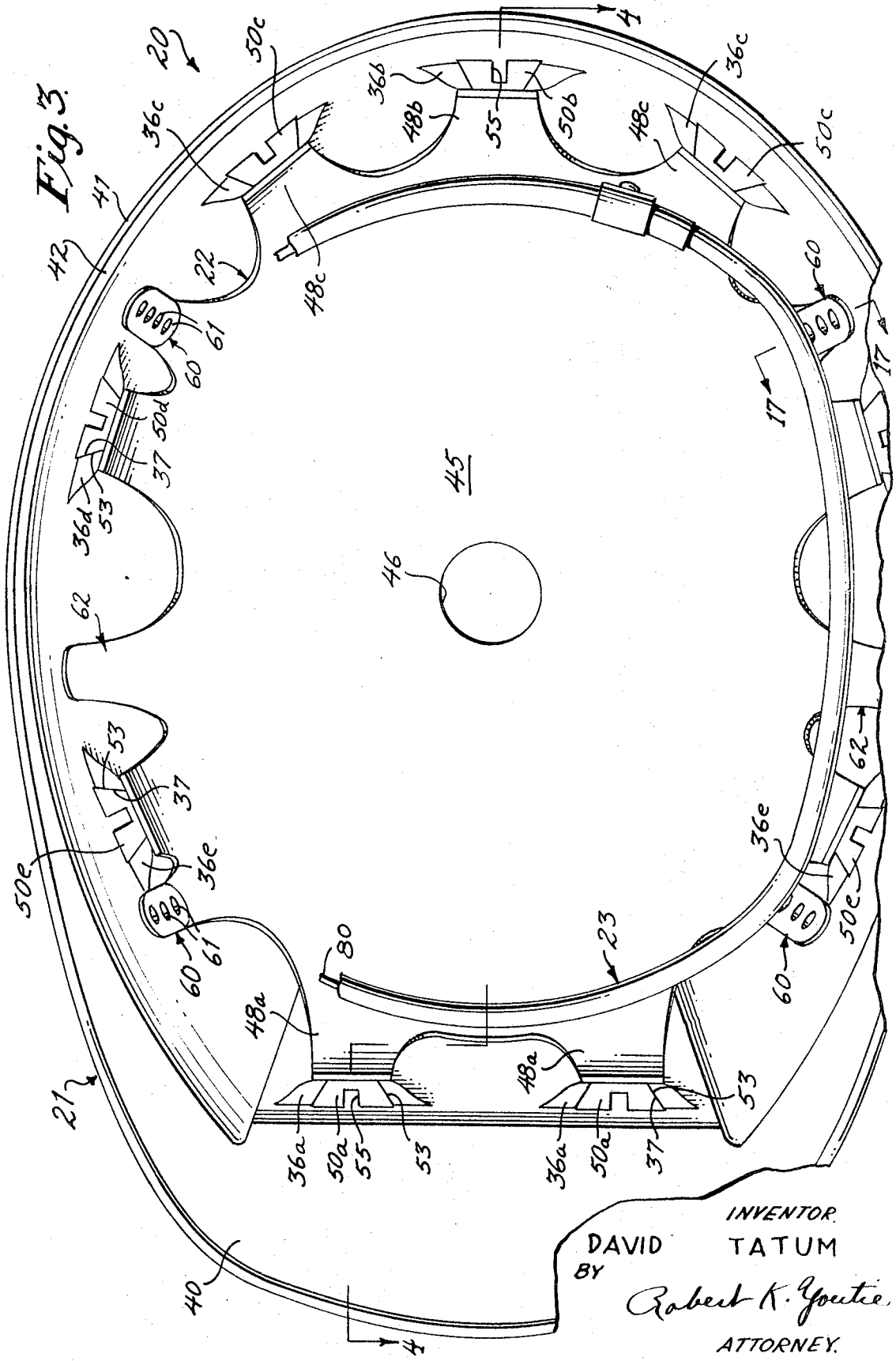


Fig. 17.

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Fig. 3.



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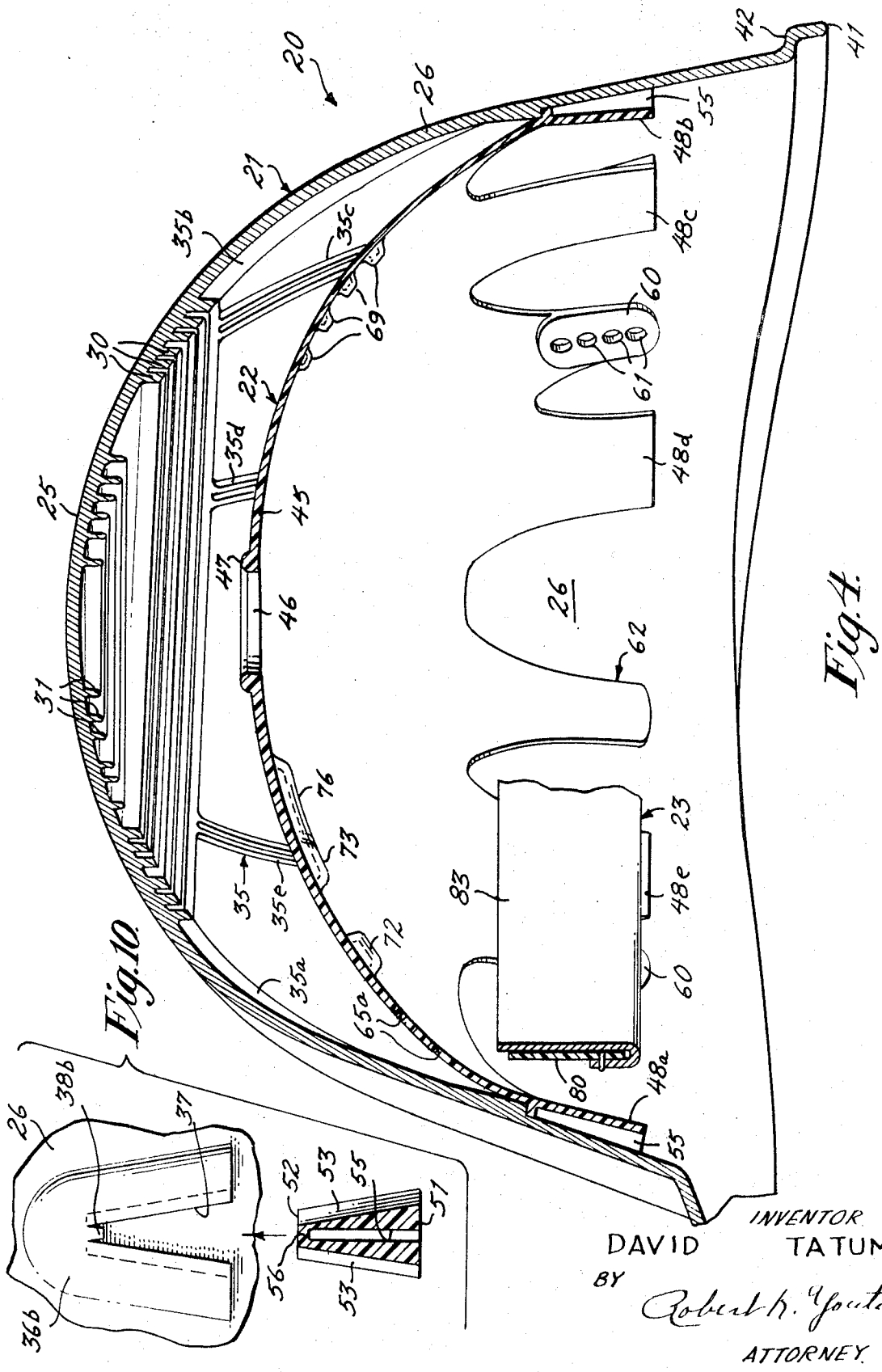


Fig. 4.

Fig. 10.

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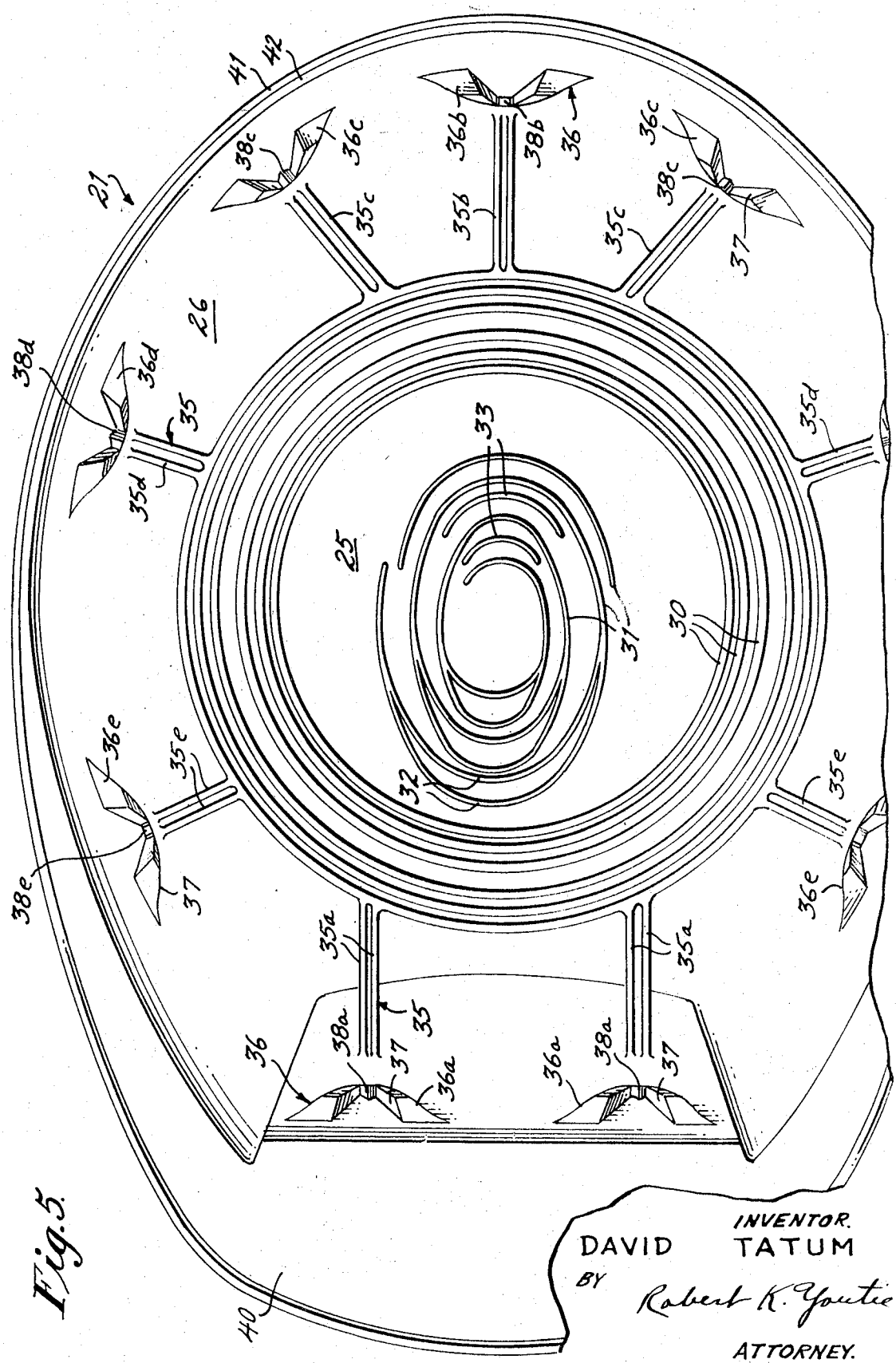
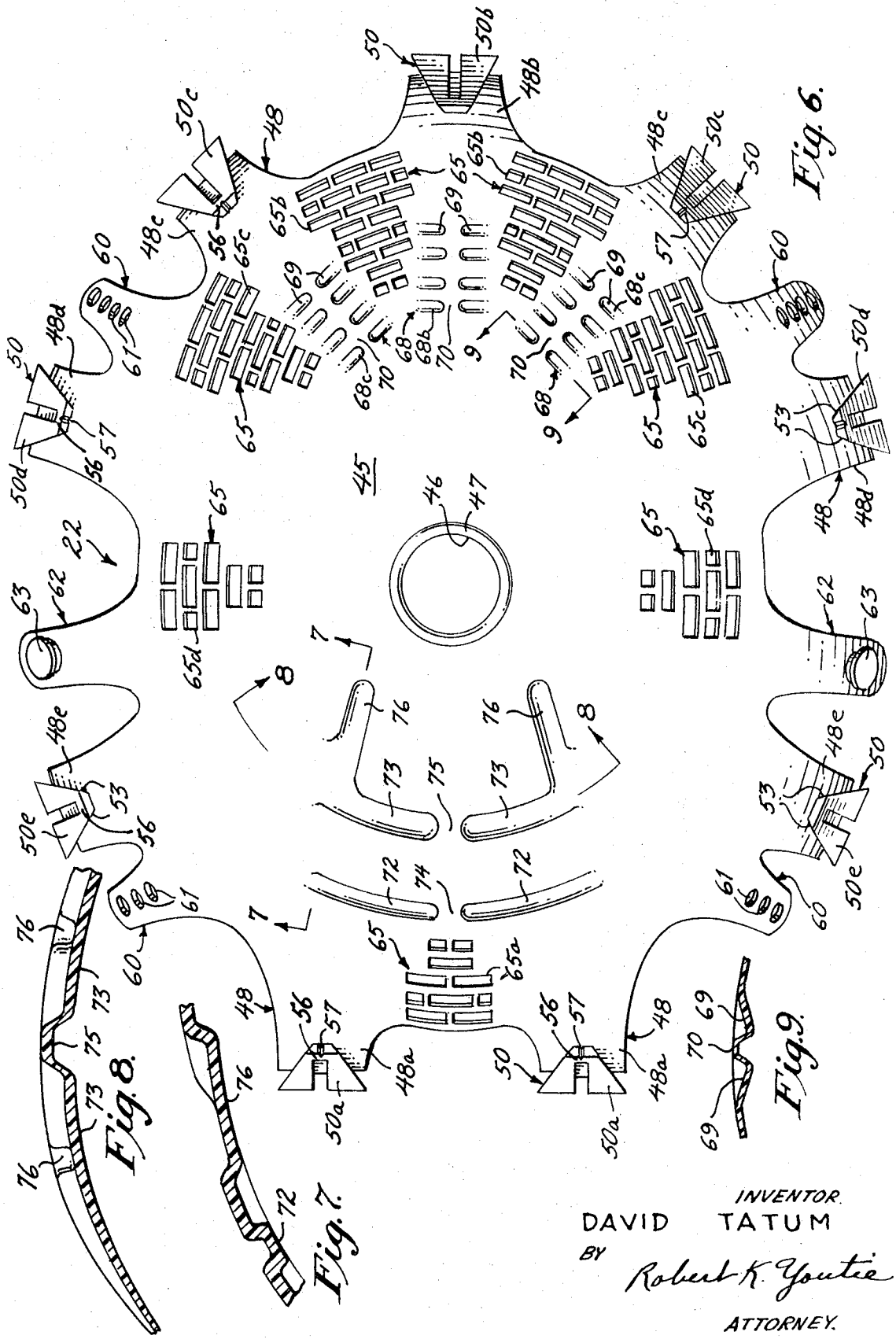


Fig. 5.

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PROTECTIVE HEADGEAR

BACKGROUND OF THE INVENTION

As is well known to those versed in the art, protective headgear, sometimes called safety hats and caps, are constructed for protection of the wearer's head against impact, penetration, and electrical shock. In the past, protection against impact has been considered as afforded by yieldability of the head-engaging part or suspension, while protection against penetration has been considered as provided by the shell and resistance to electrical shock by the insulation characteristics of the materials.

SUMMARY OF THE INVENTION

In accordance with the instant invention, it is an important object to provide a unique structure and resultant function wherein protection against impact is afforded not only by head-engaging part or suspension, but also by the outer shell, and further by unique cooperative interrelation, both structurally and functionally, between the suspension and shell.

It is a further object of the present invention to provide a protective headgear having the advantageous characteristics mentioned in the preceding paragraph, which transmits considerably less force to the wearer's head than prior constructions without disengagement nor permanent deformation of, or damage to any components of the headgear.

It is a further object of the present invention to provide a protective headgear of the type described wherein both the shell and suspension cooperate to deflect a falling object upon impact, so as substantially to reduce the effective mass of the falling object, and minimize the possibility of injury to a wearer.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a bottom perspective view showing a protective headgear of the present invention, with parts broken away for increased clarity of illustration.

FIG. 2 is a side elevational view showing the exterior of a protective cap of the present invention.

FIG. 3 is a bottom plan view, taken generally along the line 3–3 of FIG. 2, partly broken away and omitting certain details of the suspension for purposes of clarity.

FIG. 4 is a sectional elevational view taken generally along the line 4–4 of FIG. 3, with the headband broken away and details of the suspension omitted for clarity.

FIG. 5 is a bottom plan view of the outer shell apart from the suspension and headband, also broken away.

FIG. 6 is a top plan view of the suspension of the instant invention, apart from the remainder thereof, showing the details omitted from FIGS. 3 and 4, the front being leftward.

FIG. 7 is a partial sectional view taken generally along the line 7–7 of FIG. 6.

FIG. 8 is a partial sectional view taken generally along the line 8–8 of FIG. 6.

FIG. 9 is a partial sectional view taken generally along the line 9–9 of FIG. 6.

FIG. 10 is an exploded fragmentary view showing certain connection elements of the shell and suspension.

FIG. 11 is a fragmentary view showing a certain type of female connection element of the shell.

FIG. 12 is a longitudinal sectional view taken generally along the line 12–12 of FIG. 11.

FIG. 13 is a sectional view taken generally along the line 13–13 of FIG. 11.

FIG. 14 is a fragmentary elevational view showing a male connection element of the suspension.

FIG. 15 is a sectional view taken generally along the line 15–15 of FIG. 14.

FIG. 16 is an end view taken generally along the line 16–16 of FIG. 14.

FIG. 17 is a partial sectional view taken generally along the line 17–17 of FIG. 3 illustrating a connection between the headband and suspension.

FIG. 18 is a partial sectional view taken generally along the line 18–18 of FIG. 17 illustrating certain details of the headband

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, and specifically to FIGS. 1—4 thereof, a protective headgear of the present invention is there generally designated 20, and includes a relatively stiff outer member or shell 21, an inner, head-engaging part or suspension, generally designated 22, and a headband 23 circumposed about the interior of the suspension.

The outer shell 21 is best seen in FIGS. 1, 4 and 5, and is advantageously integrally fabricated of any suitable material, say plastic, and is of suitable resilience, for purposes appearing presently. In practice, it has been found preferable to integrally form the shell 21 by molding of plastic material.

The shell 21 is of a hollow, downwardly concave configuration, including an upper, central dome portion 25, and a circumferential sidewall portion 26 extending entirely about and depending from the periphery of the dome portion. In practice, the dome and sidewall portions 25 and 26 may imperceptibly merge one into the other, preferably having a smooth continuous exterior surface.

The downwardly facing cupped configuration of the dome portion 25, by its shape and resilience, is inherently possessed of a spring action in the nature of a Belleville spring. Enhancing or stiffening this spring action, the dome portion 25 is provided with a generally annular reinforcement or stiffening, such as in the form of internal generally annular ribs 30 defining an annular resilient formation. Of course, the resilient formation defined by annular ribs 30 may alternatively be provided by other suitable means, such as internal reinforcement within the shell wall of dome portion 25, say of glass fibers, spring wire filaments, or other. In any event and by any construction, the resilient formation 30 serves to enhance the Belleville spring action of the dome portion 25.

Spaced generally centrally within the resilient formation 30, there is provided in the dome portion 25 a central resilient formation, say of internal ribs 31, or other suitable construction. The resilient formation 31, as best seen in FIG. 5, is located generally centrally within the outer dome portion resilient formation 30, and is of an ovaloid or elongate configuration in the forwardly and rearwardly direction. More specifically the ribs 31 are of generally concentric ovaloid configuration, being further reinforced at their forward and rearward ends, as by branching ribs 32 in the forward region and relatively short separate lengths of ribs 33 in the rearward region. The forward and rearward end regions of central resilient formation 31 are therefore more stiffly reinforced; and further, the forward end region of the resilient formation 31 is of greater stiffness, by its connected branch ribs, than the rearward region thereof with its separate or unconnected additional length of ribs. By this construction, the resilient formation 31 is of a varying spring constant in the forwardly and rearwardly direction, and specifically, is of a decreasing spring constant in the rearward direction. Also, the location of the resilient formation 31 spaced within the resilient formation 30 is such that the formation 31 is located eccentrically forwardly, so as to further increase the spring constant in the forward region of the dome portion 25. By this construction of resilient forma-

tions, as will appear more fully hereinafter, a gravitationally falling object impinging more or less centrally on the exterior of the dome portion **25**, is caused to rebound or deflect obliquely by the resilience of the shell, and more specifically to deflect obliquely rearwardly.

In addition, the outer shell **21** is formed with a plurality of reinforcement formations extending radially outwardly from the resilient formation **30**, say the internal ribs **35** formed interiorly on the sidewall portion of the shell. The reinforcing ribs **35** may assume the form of other reinforcement or strengthening, such as by strengthening materials embedded in the shell, which reinforcement is all in the nature of a columnar formation, serving to reinforce and support the dome portion **25** by columnar action. While the number and arrangement of columnar formations may vary, it has been found suitable to employ a pair of forwardly extending columnar formations **35***a*, a single rearwardly extending columnar formation **35***b*, a pair of obliquely rearwardly extending columnar formations **35***c*, a pair of laterally obliquely extending columnar formations **35***d*, just rearwardly of center, and a pair of laterally obliquely forwardly extending columnar formations **35***e*, just forwardly of center. The several columnar formations **35** may all terminate at their lower ends in a lower circumferential region of the shell sidewall **26**. At the lower end of each columnar formation **35**, there is formed internally of the shell sidewall **26**, a female connection element or socket **36**. Specifically, a pair of forwardmost sockets **36***a* are each formed adjacent to the lower end of a respective forwardmost columnar formation **35***a*, a socket **36***b* being formed adjacent to the lower end of rearmost columnar formation **35***b*, a pair of sockets **36***c* each formed adjacent the lower end of a respective columnar formation **35***c*, a socket **36***d* formed adjacent to the lower end of each columnar formation **35***d*, and a socket **36***e* formed adjacent to the lower end of each columnar formation **35***e*. The female connection elements or sockets **36** are each preferably formed integrally with the shell **21**, as by a protuberance on the inner surface thereof, and formed therein with a downwardly and inwardly opening dovetail groove or slot **37**. That is, each socket **36** is formed with a slot or groove **37** having an undercut or dovetail configuration, which opens both downwardly and radially inwardly of the shell. Further, each socket slot **37** tapers upwardly to a closed upper end. The closed upper ends of sockets **36***a* are designated **38***a*, and correspondingly the closed upper ends of sockets **36***b*, **36***c*, **36***d* and **36***e* are each respectively designated **38***b*, **38***c*, **38***d* and **38***e*.

By way of illustration, the sockets **36***a*, **36***c* and **36***d* are of one type, as illustrated in FIGS. **11**, **12** and **13**. The socket **36***a* there illustrated has its upwardly convergent, undercut groove or slot **37** terminating at its closed upper end in a downwardly pointed engaging member **38***a* closing the upper end of the slot. The downwardly pointed engaging member **38***a* may be relatively weak, as for deflection or breakage under force, for purposes appearing presently.

The sockets or female connection elements **36***b* and **36***e* are substantially identical to the remaining sockets or female connection elements **36***a*, **36***c* and **36***d*, except that the closed upper ends **38***b* and **38***e* of the upwardly convergent slots or grooves **37** are defined by downwardly tapering, blunt end engaging members. An engaging member **38***b* is shown in FIG. **10** as closing the upper end of slot **37** formed in socket **36***b*, and being of relatively stout proportions for substantial resistance to breakage and deflection.

The lower circumferential edge of the shell **21** may be provided with a circumferentially extending brim in the manner of a hat, or with a forward peak **40**, as illustrated, to define a cap. In the cap construction, as illustrated, it is preferred to reinforce the rearward lower edge region, as by an integral formation of outwardly offset depending flange **41**. That is, the integral flange **41** is outwardly offset, as by a generally horizontal outwardly extending offsetting portion **42**, see FIG. **4**.

Considering now the suspension **22**, best seen in FIGS. **1**, **3**, **4** and **6**, the suspension may advantageously be integrally fabricated of flexible resiliently yieldable material, say by molding of suitable plastic, and includes a sheetlike head engaging part **45**, which may be formed of a domed configuration for conforming engagement with the crown of a wearer's head. The sheetlike head-engaging part **45** may have a central through opening **46** bounded by a circumferential bead **47**.

Extending generally radially outwardly and depending from the head-engaging part **45**, being located in angularly spaced relation circumferentially thereabout, are a plurality of flexible suspender extensions **48**. The extensions or suspenders **48** may advantageously be of sheetlike formation integral with the head-engaging part **45**, and of a number and arrangement corresponding to that of the shell sockets **36**. More particularly, the suspension **22** may include a pair of forwardly extending suspenders **48***a*, a rearward suspender **48***b* generally along the forward and rearward centerline, a pair of obliquely rearwardly extending suspenders **48***c* angularly spaced on opposite sides of the rearwardly suspender **48***b*, a pair of laterally obliquely and rearwardly extending suspenders **48***d*, respectively on opposite sides of the head-engaging part **45** rearward of the center opening **46**, and a pair of obliquely laterally and forwardly extending suspenders **48***e* on opposite respective sides of the head-engaging part forward of the center opening **46**.

The suspenders **48** are each provided on the outer side of its distal end region, as by integral formation therewith, with a male connection element, lug or insertion member, each generally designated **50**. By way of specific designation, the male connection elements or lugs **50** are respectively designated by the alphabetical suffix of the corresponding suspender. That is, the forwardmost male elements **50** are specifically designated **50***a*, while the rearmost male connection element is specifically designated **50***b*, the connection elements of suspenders **48***c* being specifically designated **50***c*, the connection elements of suspenders **48***d* being specifically designated **50***d*, and the connection elements of suspenders **48***e* being specifically designated **50***e*.

The male connection elements or lugs **50** are all substantially identical in construction, being of a trapezoidal outline configuration and are arranged to taper or converge from a lower larger end **51**, see FIGS. **10** and **15**, to an upper smaller end **52**. Further, the tapering or convergent sides **53** are undercut in dovetail fashion, as may be seen in FIG. **16**, and elsewhere.

Each of the male elements or lugs **50** may further be formed with a groove, slot or recess **55**, which groove may extend upwardly and inwardly through the lower larger lug end **51**, longitudinally along and between the convergent sidewalls **53**, and terminate short of the inner end wall **52** to define a web or wall portion **56** closing the upper, inner end of the groove. As best seen in FIG. **6**, the lugs **50***a*, **50***c* and **50***d* differ slightly from the lugs **50***b* and **50***e*, in that the former are provided exteriorly on the wall portion or web **56** with a weakening line or groove **57**. The weakening lines or grooves **57** are located to respectively receive the pointed engaging members or wedges **38***a*, **38***c* and **38***d*, to facilitate piercing rupture by the engaging members of the engaged wall portions. The relatively blunt engaging members **38***b* and **38***e* engage with the nonweakened walls **56** of corresponding lugs **50***b* and **50***e*, to provide greater resistance to relative shell and suspension movement.

In addition to the extending arms or suspenders **48**, the suspension **22** includes a plurality of radially extending, circumferentially spaced flexible extensions or legs **60**, each provided with a row or series of fastener receivers or holes **61**, for selective connections to the head band **23**.

Additionally, a pair of laterally opposite radial extensions or legs **62** may be provided on the head-engaging part **45** of the suspension **22**, having fastener elements **63** of any suitable construction, for connection to opposite ends of a chin strap, if desired.

The flexible sheet material of the head-engaging part **45** is preferably of a gradually varying thickness, being increasing in the forward direction, so as to have increasing yieldability in the rearward direction, as best seen in in FIG. **4**. Further, the head-engaging part **45** is provided at a plurality of spaced locations with groups of vent openings, each group being generally designated **65**. The vent opening groups **65** are each formed of staggered elongate openings or slots, so that the vented region is yieldably distensible, in the general manner of expanded metal. More specifically, the vent opening groups **65** are each of generally triangular configuration, tapering radially inwardly toward the central opening **46**, and each group is located intermediate an adjacent pair of extension arms or suspenders. In particular, a forwardmost vent opening group **65***a* is formed in the head-engaging part **45** spaced between the forwardmost suspenders **48***a*, while a pair of laterally spaced rearwardmost vent opening groups **65***b* are each located on opposite sides of the rearwardmost suspender **48***b*, intermediate the latter and the respective, next adjacent suspender **48***c*. Additionally, an obliquely rearwardly disposed vent opening group **65***c* is formed in the head-engaging part **45** of intermediate each suspender **48***c* and the adjacent forward suspender **48***d*, while a pair of side vent groups **65***d* are each formed between an adjacent pair of suspenders **48***d* and **48***e*. The vent opening groups **65** are thus sufficient in number and size to afford adequate ventilation to wearer's head, while further affording resilient yieldability for absorbing impact force.

The haed-engaging part **45** of the suspension **22** is further formed in the rearward region thereof, with a plurality of areas generally designated **68** of deformable formations. As best seen in FIG. **6**, it will be apparent that the areas **68** of deformable formations are each in radial alignment with a respective suspender **48***b* and **48***c*, being correspondingly designated respective areas **68***b* and **68***c*. More specifically, the formations of each area **68** may comprise a plurality of pairs of laterally spaced integrally formed depressions **69**, which pairs of depressions are arranged in alignment with each other to define a pair of generally radially extending rows on opposite sides of a radial suspension portion **70** extending between the adjacent pairs of depressions. That is, the depressions **69** are formed integrally of the head-engaging part **45**, and the radial interdepression suspension portion **70** of each group of depressions is generally in radial alignment with a respective suspender **48**. The depressions **69** are depressed downwardly for bearing engagement with a wearer's head, being of relatively light gauge for soft cushioning action against the wearer's head. Further, the relatively light gauge of the suspension portions **70** enhances stretchability thereof under force, for purposes appearing presently.

The forward, relatively heavy gauge region of the head-engaging part **45** is formed with relatively large pairs of laterally extending depressions **72** and **73**. That is, a forward pair of laterally extending, spaced depressions **72** are formed in the head-engaging part **45** with the interdepression region **74** generally along the forward and rearward centerline of suspension. A relatively large pair of laterally extending, spaced depressions **73** are formed just rearwardly of the depressions **72**, the interdepression space **75** being also along the forward and rearward centerline of the suspension; and, the outer regions of the depressions **73** are formed with further depressions **76** extending generally radially inwardly. The relatively large depressions **72** and **73**, extending laterally of the suspension **22**, are engageable with the forward crown portion of a wearer's head for cushioning against the latter, and may have a rolling action thereon upon rearward shifting of the outer shell, as will be described more fully presently.

The headband **23** may include an elongate strip **80** bent upon itself to define a closed loop having overlapping end portions **81** and **82** detachably secured together by suitable fastener means. A sweatband **83** may be secured along one edge of the strip **80**, being folded inwardly to cover the inner side of the headband. A transverse extension **84** may be formed on one end portion **82** of the strip **80**, being wrapped about the other end portion **81** and secured in its wrapped condition, as by a fastener **85**.

At several locations spaced along the strip **80**, there are provided fasteners for detachable connection to the suspension legs **60**, as by headed studs **86**. The rearward locations of connection to the suspension legs **60** are provided with upward extensions **87** for carrying the fasteners **86**. The upward extensions **87** serve to displace the rearward region of the headband downwardly for enhanced gripping action with a wearer's head, especially when a wearer tilts his head forwardly.

In the assembled condition of suspension **22** with the outer shell **20**, the forward male engaging elements or lugs **50***a* are each inserted upwardly into the forward female connection elements or sockets **36***a*, as seen in FIG. **3**. Similarly, the male connection elements **50***b*, **50***c*, **50***d* and **50***e* are respectively engaged upwardly into the female connection elements or sockets **36***b*, **36***c*, **36***d* and **36***e*. The male connection elements or lugs are firmly connected to the female connection elements or sockets by frictional engagement therein; or, additional detent means may be provided if desired.

Under the imposition of great impact force, as in the conventional testing procedure with the assembled headgear on a head form, a weight is dropped generally centrally onto the outer shell **21**. As discussed hereinbefore, lesser forces applied in this manner will cause obliquely rearward deflection of the weight, as by the individual and combined actions of the resilient formations **31** and **30**. Further, the columnar formations **35** effect transmittal of downward forces through the sockets **36** to the suspension **22**.

Tending to absorb or delay the transmittal of such forces to the suspension **22** are a number of structural features described hereinbefore. For example, the upward tapering of the sockets **36** and the wedge configuration of the several lugs **50**, together with the yieldability or compressibility of the lugs afforded by the slots **55**, permit of displacement between the sockets **36** and lugs **50** to absorb substantial forces.

Further, the pointed engagement members or wedges **38***a*, **38***c* and **38***d*, being impaled against the weakened end wall portions **56** of lugs **50***a*, **50***c* and **50***d*, as by rupture of the end wall portions and distortion of the engaging members, permits of additional, delayed relative movement between the outer shell **21** and suspension **22** for absorption of additional impact forces.

The bearing engagement of the relatively blunt depending engagement members **38***b* and **38***e* with the end walls **56** of lugs **50***b* and **50***e*, serves to permit of additional distention and relative displacement, although less than that afforded by the action of wedge shaped engagement members **38***a*, **38***c* and **38***d*.

Additionally, the deformable formations **68** of the relatively thin rearward region of suspension **22**, as by stretching of the interdepression regions **70**, permits additional downward movement of the rearward regions of the outer shell and suspension relative to the wearer's head, for additional absorption of impact force. That is, the suspension portions **70**, being in alignment with respective suspenders **48**, are yieldably extensible, and concurrent flattening of depressions **69** serves to elongate the rearward region of the suspension in the rearward direction. Simultaneously, the depressions **72** and **73** may permit of rolling action to facilitate rearward shifting of the outer shell.

Also, as discussed above, the groups of vent openings **65** are formed to facilitate distention of the suspension **22** and further effect absorption of impact force.

The above-discussed rearward shifting of the outer shell, as by stretching of the interdepression regions **70**, is further enhanced by the provision of several rearwardly located distensible vent areas **65**, and also enhanced by the rearward location of several weakened lug end wall portions **56**, as by weakening grooves **57**. These several coacting structures cooperate to effect a rearward shifting of the outer shell under impact of a falling object. By this means, the transmitted force

is substantially reduced and includes a relatively harmless forward component, the falling object being deflected obliquely rearwardly. This obliquely rearward defection enhances that described hereinbefore in connection with the resilient formations **30** and **31** of the outer shell.

From the foregoing it is seen that the present invention provides a protective headgear which fully accomplishes its intended objects, substantially reducing the apparent mass of a gravitationally impinging object, and which otherwise fully accomplishes its intended purposes.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention.

What I claim is:

1. A protective headgear comprising a flexible head engaging part adapted to rest on a wearer's head, an outer shell in spaced relation over said head-engaging part, a plurality of suspender elements spaced circumferentially about and depending from said head-engageable part toward a lower region of said shell, and interfitting connection means on said suspender elements and said shell for suspending the latter in said spaced relation, said shell having a dome portion, a sidewall portion extending circumferentially about said dome portion, and an asymmetrical resilient formation generally centrally of said dome portion for obliquely resiliently deflecting a falling object.

2. A protective headgear according to claim **1**, said resilient formation being integral with said dome portion and having a spring constant varying in the forwardly and rearwardly direction for effecting said oblique resilient deflection.

3. A protective headgear according to claim **2**, said spring constant decreasing rearwardly for effecting oblique rearward deflection of a falling object.

4. A protective headgear according to claim **2**, in combination with an additional resilient formation in said dome portion surrounding said first-mentioned resilient formation and affording said dome portion an enhanced Belleville spring action.

5. A protective headgear according to claim **4**, in combination with a plurality of columnar formations in said shell sidewall extending downwardly from said additional formation toward respective connection means.

6. A protective headgear according to claim **5**, said resilient and columnar formations being defined by shell portions of various cross sections.

7. A protective headgear according to claim **4**, said resilient formations being defined by internally thickened portions of said shell, the exterior of said shell being smooth to assure predetermined deflection of falling objects.

8. A shell for protective headgear adapted to be suspended in spaced relation over a wearer's head and comprising a dome portion, a sidewall portion extending circumferentially about and depending from said dome portion, a resilient formation centrally of said dome portion and configured to provide a spring constant varying in the forwardly and rearwardly direction, for resiliently deflecting a falling object in the forwardly and rearwardly direction, and an additional resilient formation in said dome portion surrounding said first mentioned resilient formation and affording said dome portion an enhanced Belleville spring action.

9. A protective headgear according to claim **8**, said spring constant decreasing rearwardly for effecting obliquely rearwardly deflection of a falling object.

10. A protective headgear according to claim **8**, in combination with a plurality of columnar formations in said shell sidewall extending downwardly from said additional resilient formation.

11. A protective headgear according to claim **10**, said resilient and columnar formations being defined by shell portions of controlled elastic moduli.