March 3, 1970 C. E. BENNER 3,497,873

TWO-LEVEL SUSPENSION IN A SAFETY HAT

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FIG. 1

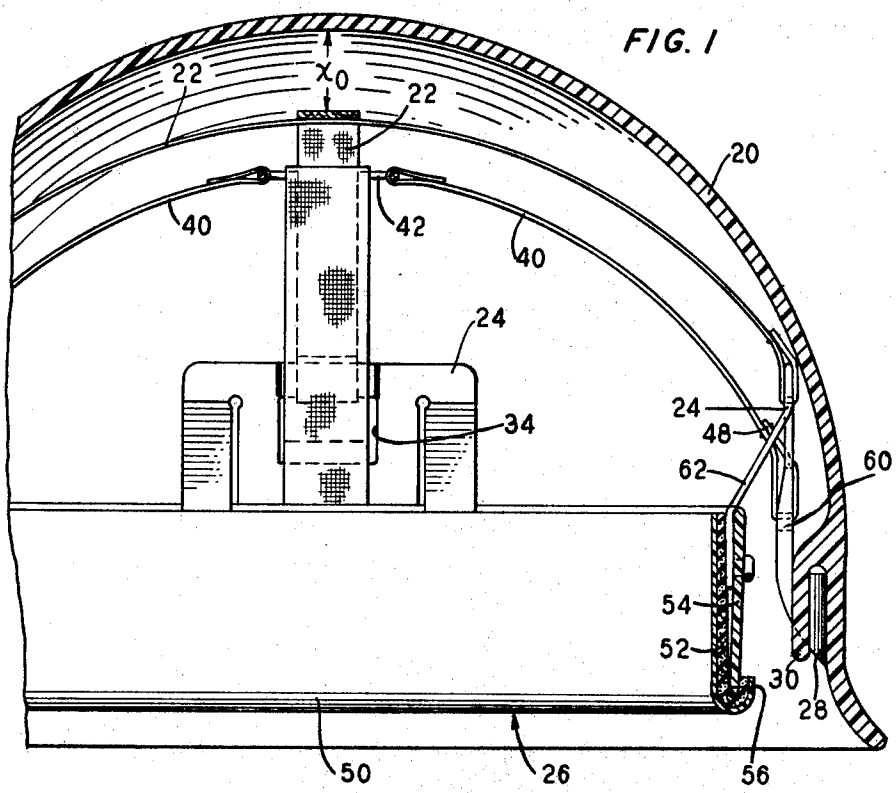


FIG. 3

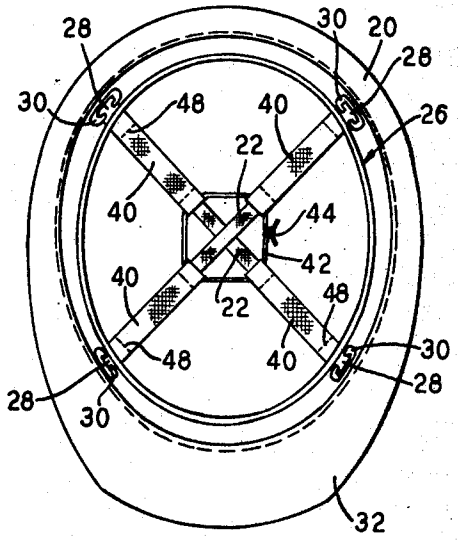
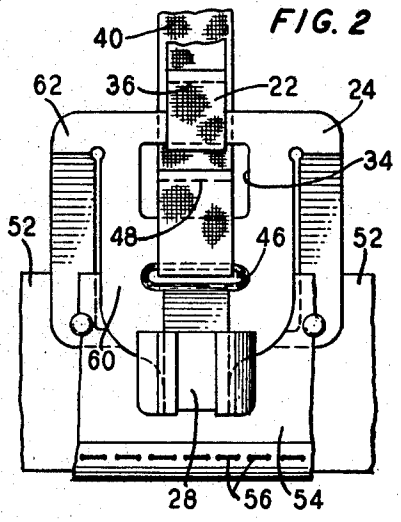


FIG. 2



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TWO-LEVEL SUSPENSION IN A SAFETY HAT

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ABSTRACT OF THE DISCLOSURE

One level of suspension functions to adjust the position and fit of the hat without changing or interfering with the operating conditions of the other level of suspension, the function of which latter is to maintain a safe clearance space between the head and the inner surface of the hard shell of the hat to protect the head from impact. Under impact, the head fitting and hat positioning level of suspension is designed to fail under a relatively minor force before the full force of the impact can be transmitted from the impacting object to the hard shell. Thereupon, the impact-absorbing level of suspension functions alone to absorb the bulk of the energy of impact. The weaker level of suspension may comprise fragile or brittle material designed to break under the minor force or to elongate easily or otherwise quickly and effectively to remove itself from action under the impact. However, this material is made strong enough to perform its function properly and may be composed of plastic or other material selected for special properties such as ease of cleaning.

BACKGROUND OF THE INVENTION

During the evolution of safety headgear it became necessary for reasons of economy to make safety hats in a single size or in a minimum of different sizes and to provide adjusting means in the hat to make it economically possible to fit a wide range of heads. For this purpose, adjustable headbands were devised so that they can be expanded or taken in to fit heads of various diameters and cap-like suspension members were connected to the headband and fastened together near the top center by a small loop of cord or other material, called a lacing cord, which is strung through the suspension members close to the very center of the suspension system. If the wearer has a very high crowned head, the loop made by the lacing cord would normally have to be enlarged so that the hat does not sit too high upon the individual's head, thus becoming insecure as well as exposing portions of his head to injury. If the wearer has a very low crowned head, the loop generally has to be taken in so that the hat does not sink too low on the wearer's head, hampering his vision and subjecting his ears to injury by the headband.

Further safety requirements have brought about the introduction of an additional suspension system that is not adjustable but is the same in all or many of the hats. This latter system limits the minimum clearance that can exist between the wearer's head and the shell of the hat. The object is to provide adequate protection for the wearer even if he fails to adjust or use the adjustable suspension system.

Most established specifications for safety hats of the class contemplated herein require that the hats be tested with just the fixed suspension system present. One of these tests involves the placing of the hat upon a force measuring device simulating a head and then striking a blow of measured force upon the top of the hat. A headgear to meet the safety specifications, must be found to absorb a certain amount of the energy of the blow, thereby transmitting less than a prescribed force to the

force measuring device, which latter supports the hat and measures the force that would be transmitted to the wearer's head in a real situation.

It is an established fact that many of the safety hats on the market today which have fixed suspension systems that are within the safety specifications for the test just described, would fail to pass the tests if in fact the hat was supported by the adjustable suspension system during the test. This is because in many of today's safety hats the action of the hat in absorbing an impact is materially altered by interaction of the adjustable suspension system with the fixed suspension system. The effect of the adjustable suspension system is generally to increase the stiffness of the combined system and hence to increase the force transmitted to the wearer's head, making the headgear of this type less safe than might otherwise be the case.

SUMMARY OF THE INVENTION

It is therefore a primary object of this invention to utilize a two suspension system in which a fixed system serves almost exclusively for impact absorption while an adjustable system serves almost exclusively for adjusting the fit and positioning of the hat on the head without materially altering the impact absorbing properties of the headgear as a whole from what they would be without the adjustable suspension system, particularly so as not to decrease the impact absorbing capability.

For this purpose, the adjustable suspension system comprises materials or elements which are relatively weak, fragile, or brittle so as to break under a specified minor force, or so resilient as to elongate easily under said force, or otherwise quickly and effectively to remove the adjustable suspension system from action during the major portion of the impact, thus permitting the true safety suspension system to function substantially alone in protecting the head of the wearer from the force of the impact, in accordance with prescribed safety requirements.

The invention substantially eliminates variations in the impact absorbing properties of the combined suspension that would otherwise occur, depending upon crown adjustment, i.e., the degree to which the inner suspension reinforces the outer, safety suspension.

The invention has the advantage that plastic parts, e.g., polyethylene, or other materials that are easy to keep clean can be used in the inner suspension in contact with the wearer's head, whereas these materials are difficult to use in the safety suspension where it is necessary to meet strength specifications at both high and low temperature extremes. Materials specifically designed for energy absorption and impact resistance over a wide range of temperatures can be used in the true safety suspension.

Further objects and advantages of the invention will appear from the following more detailed description taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational sectional view of a safety hat embodying the invention;

FIG. 2 is a fragmentary view of a portion of the hat shown in FIG. 1; and

FIG. 3 is a plan view looking toward the crown of the hat shown in FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawings, there is shown a safety hat having a hard shell **20**. An upper, fixed suspension system is illustrated as comprising a plurality of straps **22** meeting at the top without necessarily being fastened together there, and each fastened at the lower end to an anchorage

24 which is in turn attached to a composite headband 26. The anchorage 24 has attached to it, or integral with it, a projecting tongue 28 which fits detachably into a grooved hook-like projection 30 on the inner surface of the shell 20.

As shown most clearly in FIG. 3, four projections 30 are provided, spaced about the circumference of the shell 20, two near the rear, and two nearer the beak 32. The straps 22 are attached to diametrically opposite anchorages 24, crossing at the top.

The straps 22 are made of material chosen for high tensile strength under all temperature conditions of service from very low temperatures to very high. The ends of each strap are fastened securely to the anchorages 24, for example by looping around the upper part of the anchorage 24 through a hole 34 and securing with firm stitching as at dotted line 36.

The tongue 28 wedges into the grooved member 30 so that headband 26 is restrained at a fixed distance below the inside of the crown of the shell 20 and so that the straps 22 maintain a minimum clearance from the crown as indicated by the dimension x_0 shown in FIG. 1.

The fixed suspension system may be of any suitable construction and is preferably designed to absorb the energy of an impact upon the top of the hat while transmitting a minimum of force to the head of the wearer. Straps 22 may, if desired, be fastened together at the top in any suitable manner. The distance x_0 is made sufficient to provide the required margin of safety in order that the head shall not strike the shell 20 before the force of an impact is reduced to a safe amount by energy absorbing action of the fixed suspension system. For the purpose of disclosing the present invention, it is not deemed necessary to provide any further description of the fixed suspension system, except to say that in normal use the fixed suspension system does not come in contact with the head, nor does it permit any adjustment of the hat to fit the wearer's head. In other words, the function of the fixed suspension system is solely energy absorption and shielding of the wearer from dangerous impact. It is known that various devices are available in the art for this purpose.

A second suspension is provided to perform the function of fitting the hat to the head of the wearer and positioning the hat on his head in the absence of severe impact. This suspension is designed to be relatively weak compared to the fixed suspension so that it will break away or otherwise fail under a minor force without materially stiffening the initial reaction of the two suspensions in combination, or otherwise changing or modifying the action or energy absorbing properties of the fixed suspension per se. In effect, the second suspension is arranged to put itself out of action before the fixed suspension is required to react to the bulk of the impact.

The result is that the reaction of the fixed suspension to a severe impact is substantially independent of the physical properties of the second suspension. In particular, the stiffness of the fixed suspension, which is of great importance at the instant of impact, is not increased by structural reinforcement of the fixed suspension by the second suspension. That is, the reaction of the hat is not stiffened by the use of the second suspension.

Because the second suspension is not relied upon for impact protection, the wearer is protected to the full capability of the first suspension even if he neglects to fasten or make any use of the second suspension as a means of fitting the hat properly to his head.

An illustrative form of the second suspension is shown in the drawings. Fastened to the headband 26 are a plurality of straps or bands 40 which are laced together at their upper ends by means of a lacing cord 42 the ends of which are tied in a knot 44. The loop formed by the lacing cord 42 is by this means made adjustable in length to accommodate heads of different crown heights. For a low crowned head, the loop formed by the cord 42 is made small, and for a high crowned head the loop is made larger. Since the second suspension is necessarily lower or inner with reference to the fixed suspension the height of the crown that can be accommodated is limited by the position of the fixed suspension, which latter must be sufficiently spaced from the shell to provide the required protection from impact.

The individual strap 40 is fastened at its lower end as by looping it around a lower portion of the anchorage 24 through the hole 34 and a lower hole 46 and stitching as shown at dotted line 28.

In accordance with the invention, the second suspension is made of sufficient strength to support the hat on the wearer's head during ordinary use in the absence of severe impact. However, in order that the second suspension may have the desired breakaway feature as above set forth, the lacing cord 42 is made of suitably limited breaking strength so that a force relatively minor in comparison with a severe impact will break the cord, thus putting the second suspension out of action and allowing the head to come in contact with the fixed suspension. Alternatively, or in addition, the fastening of the straps 40 to the anchorage 24 or to the headband 26 as at the dotted line 48 may be made the weakest link in the second suspension as by scoring, perforating, weak stitching, or other means, so that the break will occur at or near the junction of the straps and the headband. The straps 40 may be composed of any suitable material, such as webbing, plastic, etc. A readily cleanable plastic, e.g., polyethylene, has definite advantages in respect to hygiene.

Provision may be made in known manner to make the headband 26 adjustable in circumference so as to accommodate a range of head sizes.

The composite headband 26 may be of any suitable design. For purposes of illustration, it is shown as having an inner surface liner 50 of thin plastic material backed by a layer 52 of foam rubber, foam plastic, or similar material. The lower edge of the combined liner 50 and backing 52 is bent around the bottom edge of an outer band 54 of thicker plastic and stitched thereto as at the dotted line 56.

The anchorage 24 is preferably made of molded plastic in a forked configuration, having a prong 60 to which is attached the tongue 28, and which has the holes 34 and 46. The straps 22 and 40 are shown attached to the prong 60. The other prong 62 is inserted between the foam backing 52 and the outer plastic band 54, the prong 62 being fastened to the band 54 in any suitable manner.

While illustrative forms of apparatus and methods in accordance with the invention have been described and shown herein, it will be understood that numerous changes may be made without departing from the general principles and scope of the invention.

I claim:

1. A safety hat comprising a shell and a harness for supporting the shell on a user's head and wherein said harness comprises fixed suspension means having a predetermined characteristic for transferring energy from the shell to the user's head to give protection against impact, independent adjustable suspension means for adapting said safety hat to the use of an individual user, said adjustable suspension means having incorporated therein a breakaway link which will fail under other than a minor force thereby to effectively disconnect said adjustable suspension means leaving said fixed means solely effective to give said impact protection without modification by the presence of said adjustable means.

2. A safety hat comprising, in combination, a hard shell, a fixed protective suspension attached to said shell and positioned therewithin to determine an initial clearance space between said fixed suspension and the inner surface of said shell, and an independent adjustable breakaway head-fitting suspension connected to said shell, said

latter suspension being beneath said protective suspension and initially spaced therefrom at the crown.

3. A safety hat in accordance with claim 2, in which said breakaway suspension is designed to fail under an impact which is a small fraction of the impact from which said protective suspension is designed to provide protection.

4. A safety hat in accordance with claim 2, in which said breakaway suspension comprises a headband, a plurality of straps attached to said headband, and a lacing cord for adjustably connecting said straps at the crown to accommodate a range of crown heights, and in which said lacing cord is designed to break under a force which is a small fraction of the force from which said protective suspension is designed to provide protection.

5. A safety hat in accordance with claim 2, in which said breakaway suspension comprises a headband, and a plurality of straps attached to said headband and connected together at the crown, and in which the attachment of said straps to said headband is designed to break under a force which is a small fraction of the force from which said protective suspension is designed to provide protection.

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