Dec. 14, 1965 R. F. DENTON 3,223,086

AIR-CONDITIONED HELMET

Original Filed June 21, 1960 3 Sheets-Sheet 1

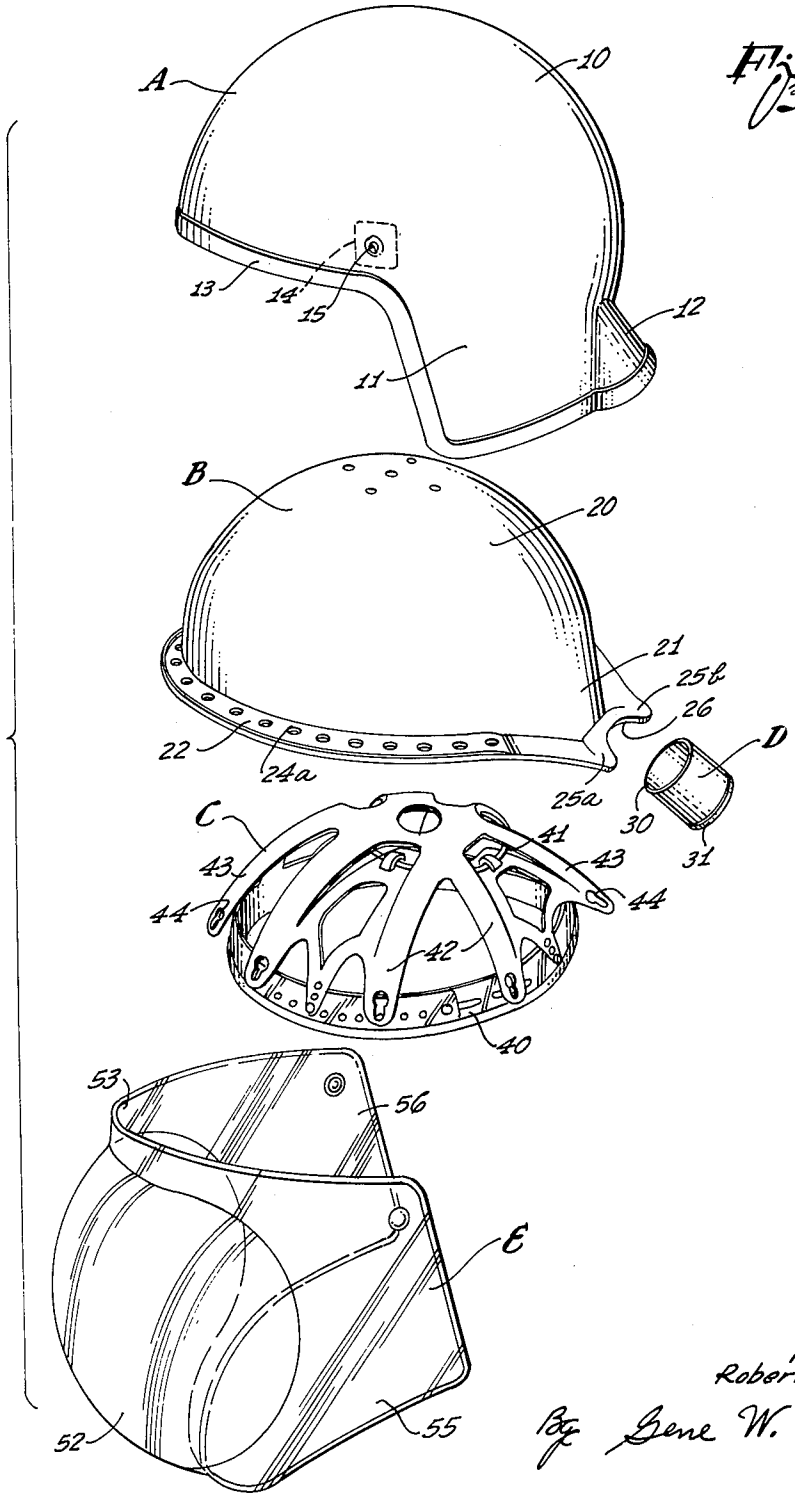

Fig. 1

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Fig. 2

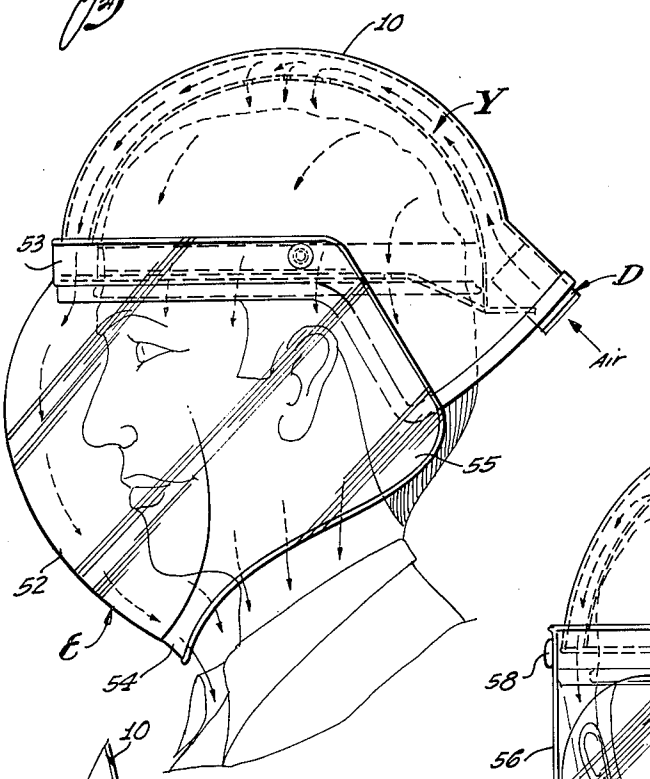

Fig. 3

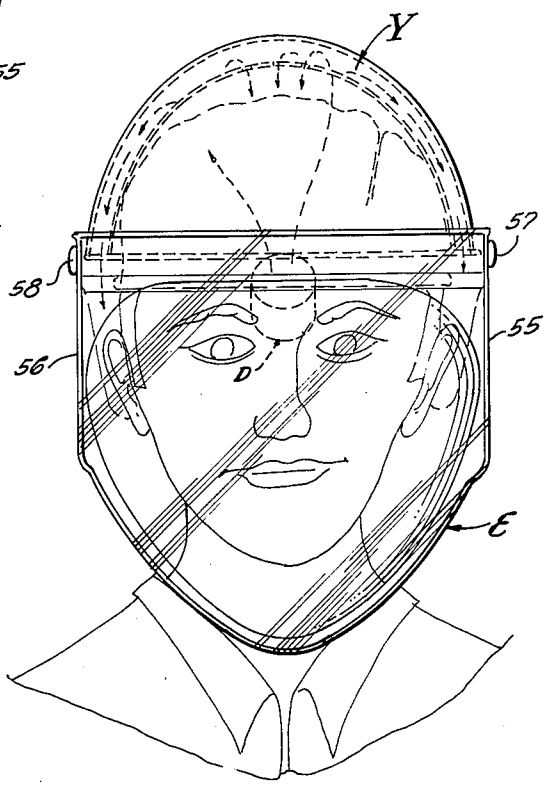

Fig. 4

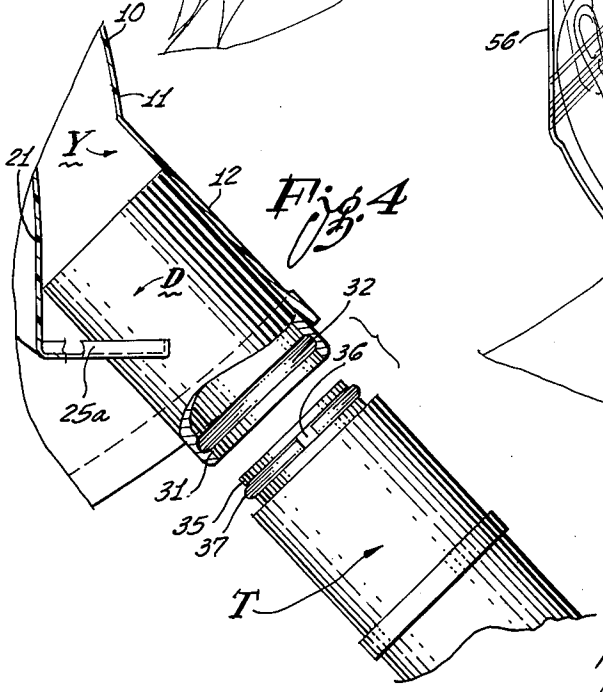

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Fig. 5

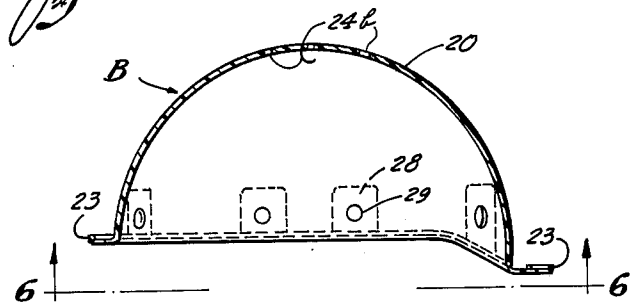


Fig. 7

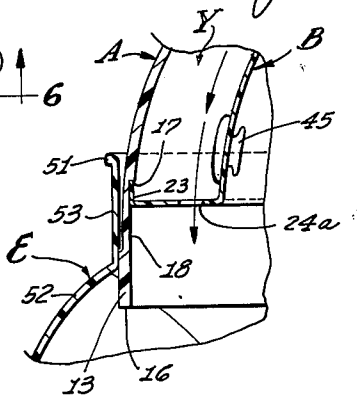


Fig. 6

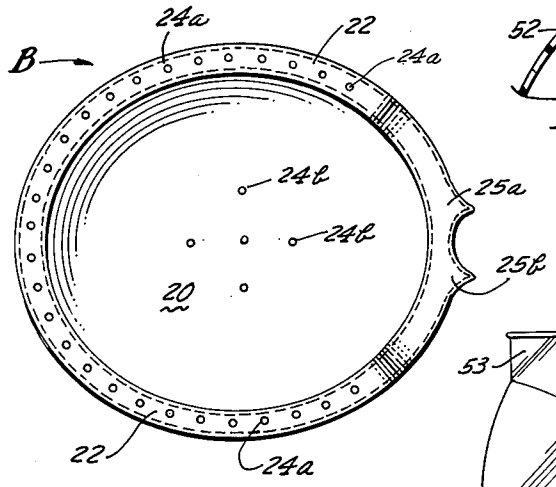
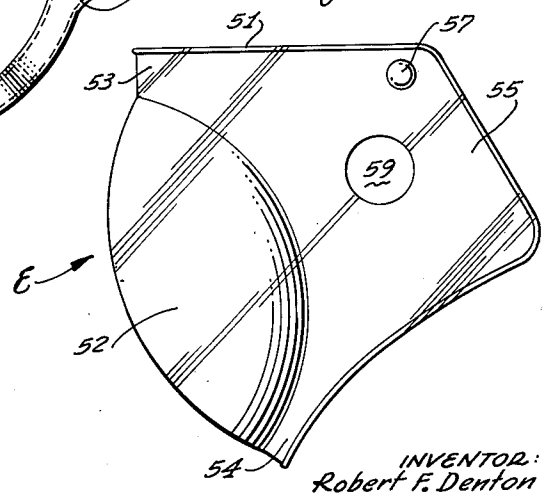


Fig. 8



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United States Patent Office 3,223,086 Patented Dec. 14, 1965

3,223,086

AIR-CONDITIONED HELMET

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Continuation of application Ser. No. 37,668, June 21, 1960. This application Aug. 5, 1963, Ser. No. 302,229
2 Claims. (Cl. 128—142)

The present application is a continuation of my co-pending application Serial No. 37,668, filed June 21, 1960 and now abandoned.

The present invention relates to a helmet adapted for receiving air from an external source and supplying it to the wearer for breathing purposes, and which is also adapted for circulating cooled or heated air about the wearer's head for heating or cooling purposes.

In air-conditioned helmets it has been known heretofore to separate an incoming air stream into a plurality of smaller streams distributed in spaced locations about the head of a wearer. Such is shown, for example, in U.S. Patent No. 735,790 to Meerza.

In prior devices of this kind it has been found, however, that the distribution pattern of the air discharged upon the wearer's head has been extremely unpredictable and variable. The efficiency and utility of the devices has accordingly been seriously limited.

The present invention is based upon a recognition of the foregoing problem and the means of its solution. Furthermore, the present invention provides a device which is of very light weight and therefore comfortable for the wearer, and which is also extremely economical to manufacture.

One object of the invention, therefore, is to provide an air-conditioned helmet capable of discharging a plurality of air streams upon the wearer's head in a predetermined, unvarying distribution pattern.

Another object of the invention is to provide a helmet of the foregoing type which is of light weight and economical to manufacture.

An additional object of the invention is to provide a helmet of the foregoing type which is subject to being easily modified by the wearer thereof to provide a permanent change in its air distribution pattern in accordance with his particular preferences or desires.

According to the present invention a static pressure chamber or plenum is established within the helmet, having restricted air escape openings formed therein. By virtue of the static pressure of the air in the chamber, the air discharge distribution pattern is independent both of the position of the helmet relative to the wearer's head, and also of the amount of hair or other unique head configuration of the particular wearer.

Another advantageous feature of the invention is that the discharged air has a maximum amount of contact with the wearer's head before escaping into the surrounding atmosphere. More specifically, air which escapes from discharge openings at the top of the wearer's head flows past discharge openings at the sides of the wearer's head and commingles with the air discharged therefrom.

The nature, objects and advantages of the invention will be more readily apparent from the following description considered in conjunction with the accompanying drawings, in which:

FIGURE 1 is an exploded perspective view of the presently preferred form of the invention;

FIGURE 2 is a side elevational view showing the invention in fully assembled form and in place on a man's head;

FIGURE 3 is a front elevational view of the invention as shown in FIGURE 2;

FIGURE 4 is an enlarged fragmentary view, partially in cross-section, of the air inlet pipe and air hose;

FIGURE 5 is a vertical longitudinal cross-sectional view of the helmet liner;

FIGURE 6 is a bottom view of the helmet liner taken on the line 6—6 of FIGURE 5;

FIGURE 7 is an enlarged fragmentary cross-sectional view showing the lower edges of helmet shell and helmet liner and upper edge of face plate; and

FIGURE 8 is a side view of the face plate modified to provide a hearing opening therein.

Before referring specifically to the drawings the overall arrangement of the presently illustrated form of the invention will be generally described. The helmet includes inner and outer head covering members defining an air chamber therebetween, inlet means for supplying air to the interior of the chamber, and a plurality of escape openings for releasing air from the chamber at spaced positions upon the surface of the wearer's head. The helmet also includes a face plate which is pivotally supported from the outer head covering member and adapted to be selectively raised to a position in which the face of the wearer is fully exposed, or lowered to a position in which the face plate is operable in cooperation with the head covering members for circulating air about the entire head, face and neck of the wearer. The invention utilizes resilient plastic sheet members in which additional openings can be made, or existing openings closed, in accordance with a predetermined scheme, to accommodate the device to the needs of an individual user.

Referring now to the drawings, the invention is seen to include an outer head covering member or helmet shell A and an inner head covering member or helmet liner B. A support device C is adapted to rest upon the wearer's head for supporting helmet shell A and helmet liner B. A short pipe section D is inserted between the lower rearward portions of shell A and liner B and serves as an air inlet for an air chamber Y that is provided between the shell and liner. A transparent face plate E is pivotally supported from helmet shell A.

Helmet shell A is integrally formed of fairly rigid plastic sheet material, and includes an approximately semi-spherical dome portion **10** from which a tail portion **11** extends downwardly at the rear thereof. The dome portion **10** is somewhat elongated so as to conform to the shape of the human head. In the center of tail portion **11** an upwardly extending bulge **12** is formed, which is adapted to receive the pipe section D in engagement with its undersurface. A trim or bead **13** extends around the entire lower edge of the shell A.

On the inner surface of dome **10** a pair of reinforcing pads **14** are provided on opposite sides thereof. Each reinforcing pad is slightly to the rear of the longitudinal center of dome **10**, but just forward of the commencement of tail portion **11**. A snap fastener **15** extends through each reinforcing pad **14** and its adjacent dome portion, as best seen in FIGURE 1, with the operative part of the fastener being on the outer surface of helmet shell A. Snap fasteners **15** are used for pivotally supporting face plate E from helmet shell A.

Referring specifically to FIGURE 7, it will be seen that the trim or bead **13** is provided by thickening the lower edge portion of the helmet shell. On the interior of the shell, a substantial distance above its lower edge **16**, there is provided a downwardly facing circumferential shoulder **17**. The shoulder **17** is utilized for positioning helmet liner B, as will be explained.

Helment liner B is likewise formed from plastic sheet material, but with a lesser thickness and greater resilience than the outer shell. Liner B includes a dome portion **20** which is approximately semi-spherical in shape, but some-

what elongated. A tail portion **21** extends outwardly and downwardly at the rear of dome **20**. A circumferential flange **22** is formed as an integral part of liner B, and extends radially outwardly from the lower edge both of the dome **20** and of the tail portion **21**. The horizontal flange **22** has, on its outer edge, a small upwardly extending portion **23**. Flange **22** is of approximately constant width throughout, except for a pair of prongs *25a*, *25b* which form a notch **26** therebetween, said notch being located at the rearward extremity of tail portion **21** of the helmet liner.

In the fully assembled form of the invention helmet liner B is in spaced relationship with the inner surface of helmet shell A, defining an air chamber Y therebetween. The lower circumferential edge of air chamber Y is closed off by the flange **22** of the helmet liner, whose outer edge portion **23** abuts the shoulder **17** of helmet shell A in bonded engagement with inner circumferential surface **18** of the helmet shell.

Pipe section D on the upper half of its circumference is in bonded engagement with the undersurface of bulge portion **12** of the helmet shell, while the lower half of its circumferential surface is in bonded engagement with notch **26** of the helmet liner. The inner end **30** of pipe D is pointed directly toward the top center portion of dome **10**, and the shape of bulge portion **12** of the helmet shell is adapted accordingly. The inner end **30** of the pipe delivers air to the interior of chamber Y, while its outer end **31** is adapted for coupling an air tube or hose thereto.

In assembling helmet shell A, helmet liner B, and pipe D, it is preferred to use an epoxy resin for bonding purposes.

Support device C includes a head band **40**, an upper ring **41**, and an interengaging web structure **42**. Web structure **42** includes a plurality of downwardly depending straps **43** having lower end openings **44** which are adapted to receive rivets **45**. Rivets **45** are utilized to permanently fasten support device C to helmet liner B.

As best seen in FIGURE 5 the helmet liner B carries a plurality of reinforcing pads **28** which are circumferentially spaced about the lower outer surface of dome **20**. An opening **29** through each pad **28** and the helmet liner receives one of the rivets **45**, as indicated in FIGURE 7.

Referring now specifically to FIGURE 4 it is seen that the outer end **31** of pipe D carries an inner circumferential groove **32**. An air hose or tube T has an outer end **35** adapted for insertion within pipe D, and which carries an outer circumferential groove **36**. A split ring **37** occupies the groove **36** of air hose T. When air hose T is inserted within pipe D a definite amount of pressure is required to pass split ring **37** into the pipe end so as to seat within groove **32**. However, this arrangement provides a quick-disconnect coupling, and the wearer of the helmet may at any time disconnect the air hose T simply by reaching behind his back and pulling downwardly. Furthermore, the wearer of the helmet may be engaged in physical activity where there is a danger of falling, or of otherwise becoming separated from his air supply, and the air hose T will automatically disconnect from the helmet when a predetermined tensile stress is applied to it.

Face plate E includes an integrally formed transparent plastic sheet having a bead **51** encasing its entire outer edge, and a bulb or face portion **52** whose shape conforms approximately to that of a circular section of the surface of a sphere. It also includes an upper band **53** which extends across the upper end of bulb **52**, a lower band **54** extending underneath the bulb, and left and right side wings **55**, **56** on respective sides of the bulb.

Upper band **53**, together with the upper portions of side wings **55**, **56**, presents a U-shaped cross-section in the horizontal plane. Side wings **55** and **56** are mainly flat, but with considerable curvature where they merge into the upper and lower bands. Lower band **54**, together with

the lower portions of the side wings, presents a U-shaped cross-section in a plane inclined at 45° from the horizonal.

As best seen in FIGURE 2 the upper extremity of bulb **52** extends just above the lower front edge of helmet shell A, when the face plate is lowered, while the lower extremity of bulb **52** occupies a position intermediate the chin and upper chest of the wearer. As best seen in FIGURE 7 the upper band **53**, in the lowered position of the face plate, tightly engages the lower circumferential edge portion **13** of helmet shell A. Side wings **55**, **56** extend well above, well below, and well to the rear of the ears of the wearer. The wings are sloped on their rearward end edges so as to overlap the sloping trim or bead **13** on each side of the tail portion **11** of helmet shell A.

Snap fastener elements **57**, **58** are attached in the upper portions of side wings **55**, **56**, respectively, and are mateable with respective ones of the fastener elements **15** of helmet shell A. The radius of dome **10** measured in an upward direction from fasteners **15** is shorter than its radius measured to the forward edge, hence when the face plate is raised it is quickly freed from engagement with the outer front surface of helmet shell A.

A plurality of circumferentially spaced openings *24a* are formed in flange **22** of the helmet liner B. Openings *24a* extend across the front and along both sides of helmet liner B, but are preferably omitted adjacent the tail portion **21** thereof. A plurality of spaced openings *24b* are formed in the upper portion of dome **20** of the helmet liner B.

FIGURE 8 illustrates the face plate E. An optional or modified feature of the face plate which is illustrated in FIGURE 8, but not in the other figures, is the provision of a hearing opening **59** in each side wing. The size and shape of the hearing opening are not critical, and it may be located anywhere in the vicinity of the ear. The purpose of the hearing opening **59** is to make it easier for the wearer of the helmet to hear environmental sounds when the face plate is in its lowered position.

The operation of the invention is a follows. The helmet is connected to the air supply hose and is then placed upon the head of the wearer. The face plate is pivoted to its lower position. The incoming air stream passes through pipe D into chamber Y, where some degree of static pressure is built up. Top openings *24b* of helmet liner B generate small individual air streams which strike the top of the man's head. Openings *24a* generate individual air streams which strike the man's forehead as well as both sides of his head immediately above the ears.

Air is supplied to the helmet at a constant rate of flow, preferably seven cubic feet per minute. For artificial cooling or heating purposes the temperature of the incoming air is adjusted for the comfort of the individual user, and is generally in the range from 20 to 40 degrees F. below or above the ambient temperature.

The novel structure of the invention causes the distribution of air within the helmet to be accomplished without dependence upon the particular position of the helmet relative to the wearer's head. That is, if the helmet is cocked sideways the air distribution pattern remains the same. When the helmet is used for artificial cooling or heating purposes there is a considerable advantage in directing the main portion of the incoming air in individual streams upon the head surface at approximately the lower edge of the hairline. Greater heat interchange by heat conduction is achieved, because of the high velocity impact between air particles and the exposed skin surface.

Each individual user of the helmet may have different preferences as to how the air streams should be distributed about his head. The construction of the helmet liner B from plastic sheet material permits additional air openings to be easily made, while previously existing openings may if desired be closed off with adhesive tape. Thus, the general concept of the invention is simply that a plurality of spaced openings are formed in the helmet

liner B, the exact locations of which may be determined by the individual user.

Another advantage of the invention is that if the face plate becomes scratched or marred it may be conveniently and economically replaced while retaining the original head assembly (helmet shell A, helmet liner B, support device C and pipe D). A further advantage of the face plate arrangement is that the individual user may either leave the side wings intact, so that his ears are fully covered, or he may cut hearing openings therein to improve his hearing of environmental sounds. The user may also provide himself with two different face plates, one with hearing openings and one without, so as to accommodate various noise conditions.

When the invention is used only for supplying filtered breathing air it has a number of distinct advantages. First, it is light in weight and hence comfortable to wear. Second, it is economical both in initial cost and in maintenance. Third, a full range of vision is provided for the wearer. Fourth, the distribution of air within the helmet prevents any undesired accumulation of perspiration about the head or neck. Fifth, the large air exit spaces about the neck make breathing easy, since there is no pressure differential involved either in inhaling or in exhaling.

When the invention is used for artificial cooling or artificial heating purposes it provides the advantage of very efficient heat interchange between the incoming air and the head, neck and lungs of the user. Efficient heat interchange is achieved not only by virtue of the locations where the individual air streams are directed, but also by virtue of their velocity of impact with the skin surfaces. Another advantage of the invention when used for artificial cooling or artificial heating purposes is that is achieves a uniform temperature of the air in the entire head and neck region.

A specific advantage of the invention when used for artificial cooling purposes is that the high velocity impact of air particles upon the exposed skin surfaces increases the rate of evaporation of surface moisture, with its attendant cooling effect.

The invention has been described in considerable detail in order to comply with the patent laws by providing a full public disclosure of at least one of its forms. However, such detailed description is not intended in any way to limit the broad features or principles of the invention, or the scope of patent monopoly to be granted.

What I claim is:

1. An air-conditioned helmet comprising, in combination:

an unbroken approximately semi-spherical helmet shell;

an approximately semi-spherical air distributing helmet liner supported within said shell and peripherally engaging said shell to provide an air chamber between the shell and liner for retaining air under pressure, said liner having a plurality of restricted flow openings therein for releasing air at various points about the head of the wearer;

air inlet means adapted to be connected to a source of air under pressure and for delivering air to the interior of said chamber, said air inlet means including a short pipe section fastened between the lower rearward portions of said shell and liner, and being so directed as to discharge entering air against said liner at a point removed with respect to said restricted flow openings;

and means within the liner for supporting said liner upon, around and spaced from the head of a wearer, whereby air directed into the air chamber and discharged through said restricted openings can flow down, over and around the wearer's head and from beneath the liner for airing and breathing purposes.

2. An air-conditioned helment comprising, in combination:

an unbroken approximately semi-spherical helmet shell;

an approximately semi-spherical helmet liner supported in spaced relationship within said shell to provide an enclosed air chamber therebetween for retaining air under pressure, said helmet liner including an outwardly extending circumferential flange which engages the inner circumferential surface of said helment shell and closes the bottom end of said chamber;

air inlet means for delivering air under pressure to the interior of said chamber, comprising a short pipe section fastened between the lower rearward portions of said shell and liner, and whose protruding end is adapted for connection of an air supply hose thereto;

said helmet liner having a plurality of spaced restricted openings formed therein for releasing air from said air chamber at various points about the head of a wearer, including circumferentially spaced openings formed in said flange for directing air to the forehead and the sides of the wearer's head, and openings formed in the top portion of said liner for directing air upon the top of the wearer's head;

means for supporting said liner upon and spaced from the head of the wearer so as to permit the free escape of air in a downwardly direction from the space between said liner and the wearer's head;

and a transparent face plate having an inwardly curved lower extremity, said face plate being pivotally supported from said helment shell and adapted to selectively assume a lowered position in which said lower extremity extends under the chin of the wearer so as to channel the escaping air directly upon the neck of the wearer.

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