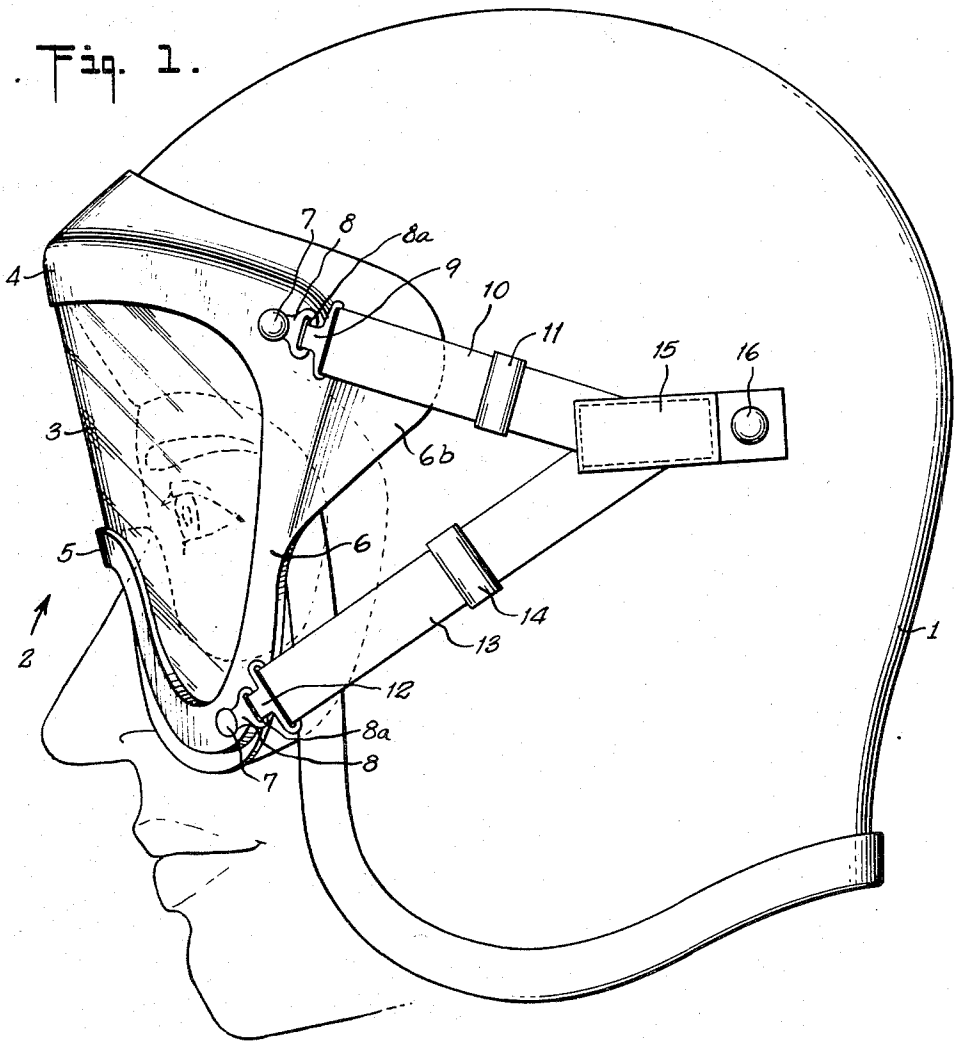
May 17, 1960 A. G. LUISADA 2,936,458

EYE SHIELD

Filed Oct. 14, 1955 4 Sheets-Sheet 1

Fig. 1.



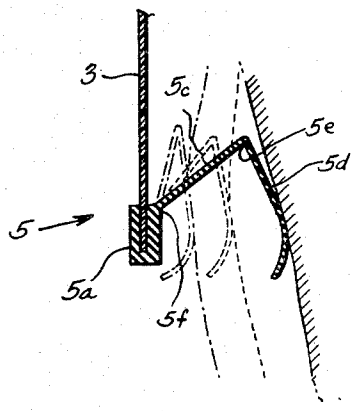


Fig. 4.

INVENTOR.
AUGUST G. LUISADA
BY Robert P. Denham
ATTORNEY

May 17, 1960 A. G. LUISADA 2,936,458

EYE SHIELD

Filed Oct. 14, 1955 4 Sheets-Sheet 2

Fig. 2.

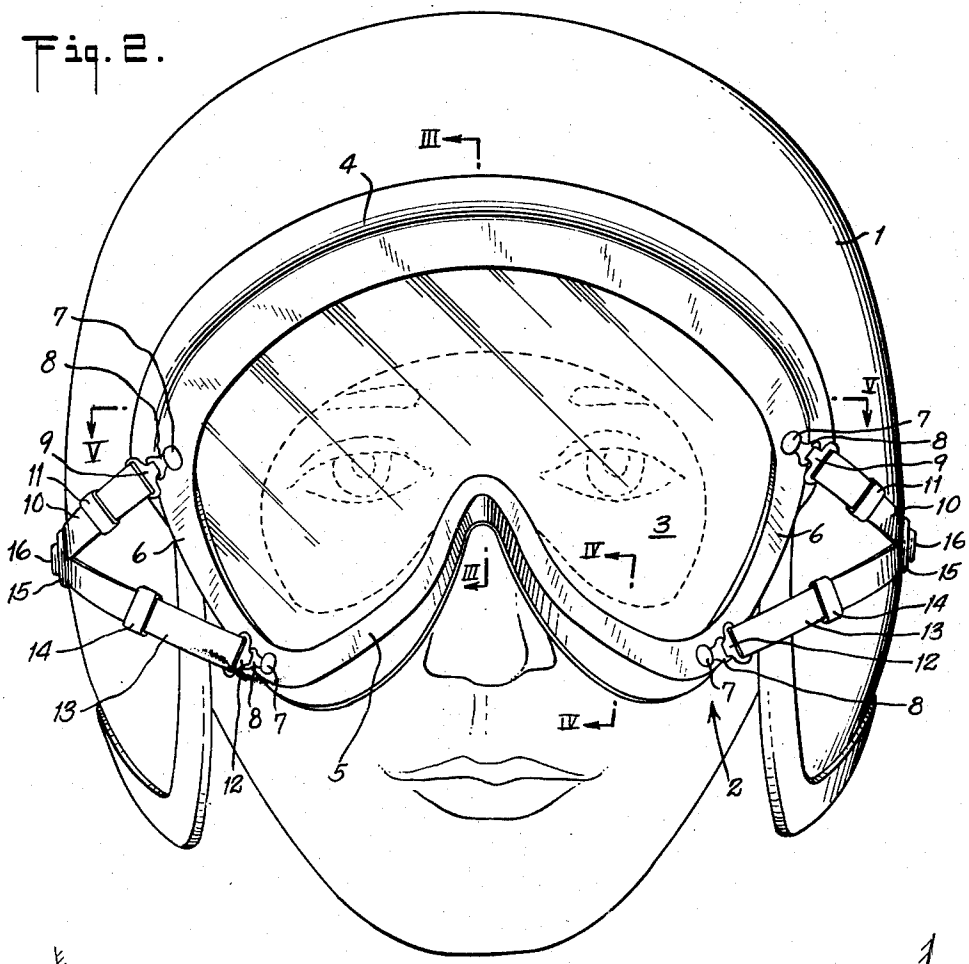
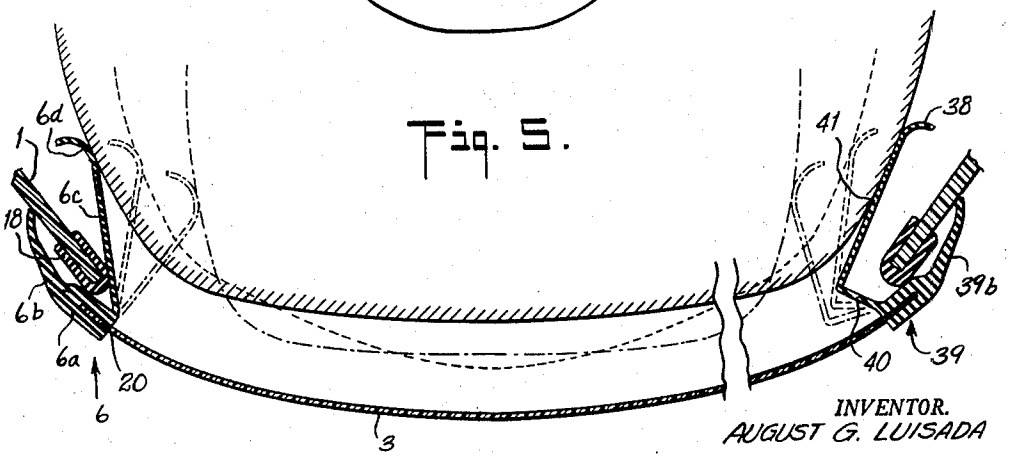


Fig. 5.



INVENTOR.
AUGUST G. LUISADA

BY Robert A. Duncan

ATTORNEY

May 17, 1960 A. G. LUISADA 2,936,458

EYE SHIELD

Filed Oct. 14, 1955 4 Sheets-Sheet 3

Fig. 3.

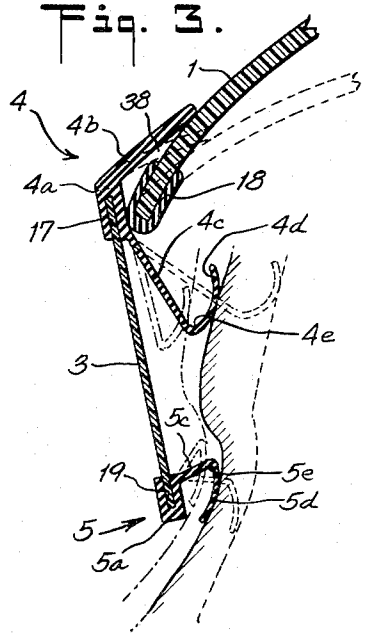


Fig. 7.

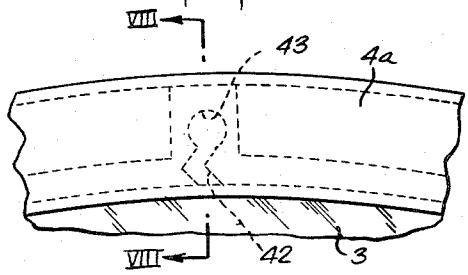
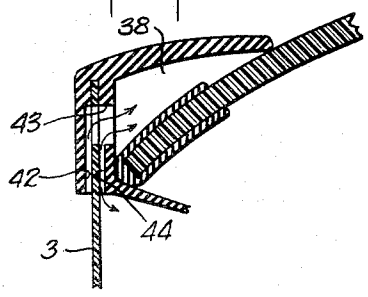


Fig. 8.



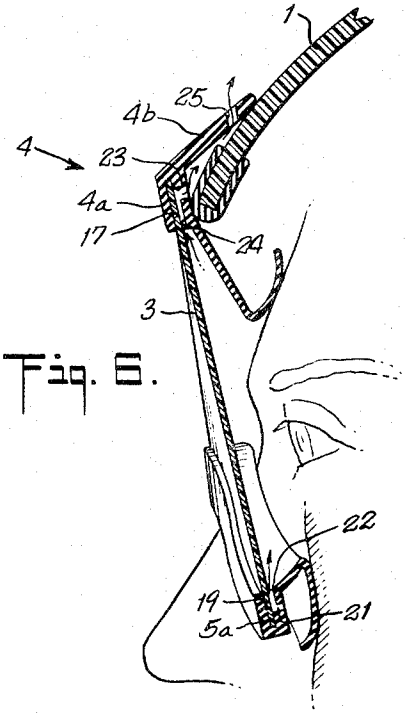


Fig. 6.

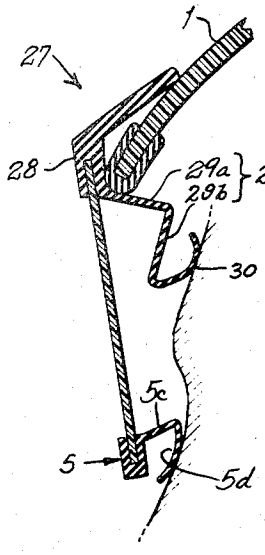


Fig. 9.

INVENTOR.
AUGUST G. LUISADA
BY Robert J. Steinhem
ATTORNEY

May 17, 1960 A. G. LUISADA 2,936,458

EYE SHIELD

Filed Oct. 14, 1955 4 Sheets-Sheet 4

Fig. 10.

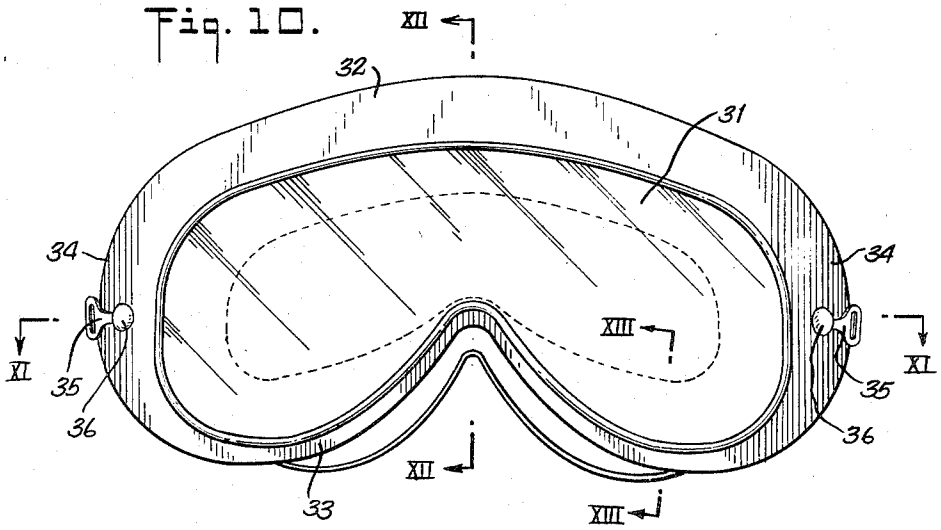


Fig. 11.

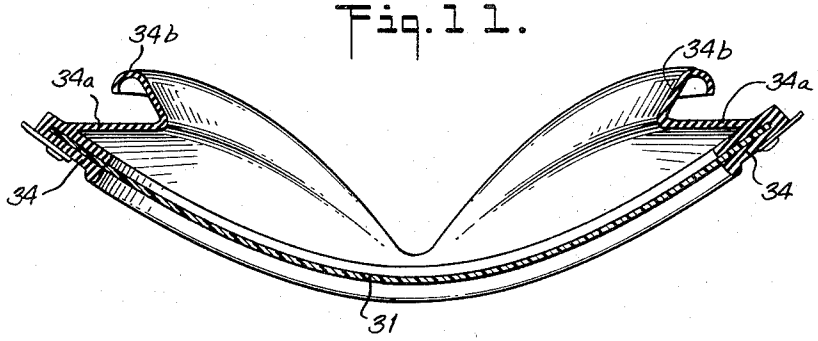


Fig. 12.

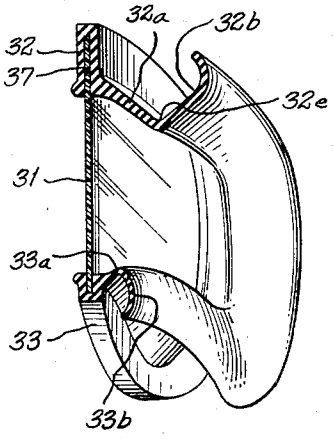
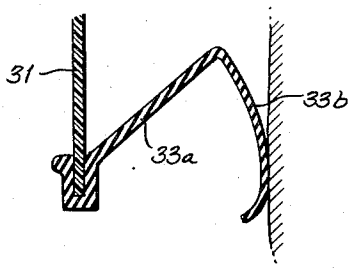


Fig. 13.



INVENTOR.
AUGUST G. LUISADA

BY Robert A. Dunham

ATTORNEY

United States Patent Office 2,936,458 Patented May 17, 1960

2,936,458

EYE SHIELD

August G. Luisada, Carbondale, Pa., assignor to Leonard P. Frieder, Great Neck, N.Y.

Application October 14, 1955, Serial No. 540,381

2 Claims. (Cl. 2—14)

This invention relates to eyeshields. It is particularly concerned with dustproof eye shields adapted to be worn in dusty atmospheres, to protect the eyes of the wearer from dust or other airborne particles, while providing adequate ventilation of the space between the shield and the wearer's eyes to prevent fogging of the shield and to promote the comfort of the wearer.

Certain shields embodying the invention are adapted to be worn with a safety helmet, in such a manner that part of the eye shield engages the shield of the helmet and another part of the shield engages the wearer's face. Certain features of the invention have their principal utility in connection with such an arrangement. Other features of the invention are of more general utility, and are adaptable for use with eye shields which are worn without any helmet.

The present invention is an improvement on the eye shields shown and claimed in the copending application of Walter C. Finken and Jackson A. Aileo, Serial No. 406,670, filed January 28, 1954, entitled "Eye Shield."

An object of the present invention is to provide an eye shield including a frame structure adapted to engage the face of a wearer closely and without leakage of air past the shield, but nevertheless with only light pressure on the face and with improved comfort to the wearer. A further object is to provide such a shield which adapts itself to a wide variety of facial contours.

Another object of the invention is to provide an eye shield of the type described, including an improved frame structure for engaging the shell of a helmet closely and without leakage, and usable with helmets of various shapes and sizes.

Another object of the invention is to provide an eye shield adapted to be worn with a safety helmet and having a first portion adapted to engage the wearer's face and a second portion adapted to engage the helmet, and having one means for adjusting the pressure between the first portion of the shield and the wearer's face and separate means for adjusting the pressure between the second portion of the shield and the shell of the helmet.

The foregoing objects of the invention are attained in the structures disclosed herein. In these structures the eye shield frame is provided with a face engaging flap of flexible resilient material. The flap has a face engaging portion having an arcuate cross-section which is convex on its face engaging side and which extends generally parallel to the wearer's face. This flap is connected by one or more hinge structures to the main portion of the eye shield frame, so that the flap pivots easily about the hinge structure when it contacts the face, and so accommodates itself to various facial contours without discomfort to the wearer.

The portion of the eye shield frame which engages the helmet includes a relatively stiff portion whose inner edge rides on the rim of the helmet shell and a flange connected to the outer edge of said stiff portion and formed of relatively flexible material which engages the

shell resiliently. Two lines of engagement between the frame of the shield and shell are thus formed, thereby providing an effective seal against undesired entry of air into the space behind the shield.

The shield is constructed so that the space between the shell and the face is ventilated through tortuous passages which effectively prevent the entrance of dirt, dust or other airborne materials but is nevertheless effective to carry away heat and moisture from the space adjacent the eyes.

The frame of the shield includes an upper rim adapted to engage the helmet shell and a lower rim adapted to engage the wearer's face. The shield is mounted on the helmet shell by means of upper and lower sets of elastic straps. The pressure between the upper rim and the shell is adjusted by means of the upper set of straps and the pressure between the lower rim and the face is adjusted by the lower set of straps.

Other objects and advantages of the invention will become apparent from a consideration of the following description and claims, taken together with the accompanying drawings.

In the drawings:

Fig. 1 is a fragmentary side elevation of an eye shield mounted on a helmet being worn by a person;

Fig. 2 is a front elevation of the eye shield and helmet shell of Fig. 1;

Fig. 3 is a fragmentary cross-sectional view taken on the line III—III of Fig. 2;

Fig. 4 is a fragmentary view, similar to Fig. 3, taken on the line IV—IV of Fig. 2;

Fig. 5 is a horizontal cross-sectional view taken on the line V—V of Fig. 2, looking in the direction of the arrows;

Fig. 6 is a cross-sectional view similar to Fig. 3, illustrating a modification;

Fig. 7 is a fragmentary elevational view of the eye shield frame of Fig. 6;

Fig. 8 is a cross-sectional view taken on the line VIII—VIII of Fig. 7;

Fig. 9 is a cross-sectional view similar to Fig. 6 illustrating another modification;

Fig. 10 is an elevational view of a modified form of eye shield constructed in accordance with the invention and adapted to be worn without an accompanying safety helmet;

Fig. 11 is a horizontal cross-sectional view on the line XI—XI of Fig. 10;

Fig. 12 is a cross-sectional view on the line XII—XII of Fig. 10; and

Fig. 13 is a cross-sectional view taken on the line XIII—XIII of Fig. 10.

Figs. 1 to 6

These figures illustrate a safety helmet generally indicated by the reference numeral **1**, mounted on the head of a person. The safety helmet may, for example, be of the type described in detail and claimed in the copending application of Leonard P. Frieder and Walter S. Finken, now issued United States Patent No. 2,739,309 of March 27, 1956, entitled "Headgear Structure."

Mounted on the helmet **1** so as to engage the upper portion of the front rim of the helmet and also to engage the face of the wearer, is an eye shield generally indicated by the reference numeral **2**. The eye shield **2** includes a window **3** mounted within a frame which includes an upper transverse frame member **4**, a lower transverse frame member **5** and side frame members **6**. All the frame members **4**, **5** and **6** are conveniently molded from rubber or other suitable moldable plastic material having similar characteristics, and are preferably molded in one piece.

At the corner of the frame, i.e., at the junction of the transverse frame members 4 and 5 and the side frame members 6, there are fixed rivets 7 which hold on the frame anchor plates 8, each provided with an aperture 8a. The aperture 8a in each anchor plate 8 at an upper corner of the frame receives a hook 9 carried on the end of an elastic strap 10 provided with a buckle 11 or other suitable strap length adjusting mechanism. The apertures 8a in the anchor plates 8 at the lower corners of the frame receive hooks 12 on the ends of elastic straps 13 which are provided with buckles 14 or other suitable strap length adjusting mechanisms. The opposite ends of the straps 10 and 13 on each side of the helmet are fastened, as by sewing, to a mounting tab 15 which is attached, as by means of a snap fastener 16, to the helmet shell 1.

It may be seen that the tension in the straps 10 and hence the contact pressure between the transverse frame member 4 and the shell may be adjusted by means of the buckle 11 without substantially affecting the pressure between the lower transverse frame member 5 and the wearer's face. Similarly, the tension in the straps 13 and hence the contact pressure between the lower transverse frame member 5 and the wearer's face may be adjusted by the buckles 14 without substantially affecting the contact pressure between frame member 4 and the shell.

The details of construction of the transverse frame member 4 are best shown in Fig. 3. The frame member 4 comprises a relatively stiff, generally vertically extending portion 4a, an upper rearwardly extending flange 4b and a lower rearwardly extending flange 4c. The vertically extending portion 4a is made relatively thick and quite stiff so that it retains its shape under considerable stress. The lower edge of the portion 4a is provided with a groove 17 to receive the upper edge of the window 3. The margin of window 3 may be held in the groove 17 by any suitable anchor means such as those disclosed in the copending Finken and Aileo application, Serial No. 406,670 mentioned above.

The upper flange 4b is somewhat thinner than the central portion 4a of the frame member 4 and also more resilient. In its unstressed condition, flange 4b projects substantially at right angles to the vertical portion 4a, and is adapted to be engaged and deflected upwardly by the shell of the helmet 1 when the eye shield is mounted in place. The flange 4b may be deflected upwardly by varying amounts depending upon the contour of the particular helmet shell on which it is mounted, as indicated in the dotted line and full line positions of Fig. 3, which show the disposition of the flange 4b on helmets of two different contours. The rim of the helmet shell, which is usually covered by a grommet 18 of rubber or similar material, engages the frame portion 4a at its inner side adjacent its lower edge.

The lower flange 4c, when unstressed, projects rearwardly from the vertical portion 4a of the frame member 4 at an angle somewhat greater than a right angle. The inner end of flange 4c is joined to a flap 4d, which extends outwardly with respect to the space between the eyes of the wearer and the window 3. The flap 4d is provided near its free edge with a face-engaging portion of arcuate cross-section having a convex surface on its inner face-engaging side. The flap 4d is of very resilient, easily deformed material. At the connection between the flap 4d and the flange 4c, the material may be weakened by a crease 4e, as shown, or by providing a thin neck portion at that connection so that the flap 4d may readily bend about the crease 4e as a hinge. Other equivalent hinge structures may be used. While the structure has been described as a hinge, and the action is analogous to that of a hinge, it should be understood that all of the bending does not necessarily take place at the corners, as it would in a true hinge, but that some of the bending may take place in portions of the material spaced from the corner.

The face-engaging portion is deformed or flattened slightly from its convex arcuate contour when it is in engagement with a face. The resilience of the material and its contour should preferably be such that the angle between the face and the material at the edge of the face-engaging portion is between 30° and 60°.

The flange connecting the face-engaging flap with the main part of the frame may be replaced by any of several equivalent structures. The essential requirements of such structures are that they have substantial flexibility in a direction perpendicular to the face and that they resist substantial deformation in a direction parallel to the face.

More specifically, such structures may include a plurality of pleats or folds, instead of a single flange. Fig. 9, for example, shows an arrangement with two such pleats. The number of pleats may be increased considerably, giving an accordion effect. A particular structure considered to be suitable comprises pleats arranged in a series of steps alternately extending perpendicular and parallel to the face. In such a structure the pleats extending parallel to the face may be made relatively flexible, while the pleats perpendicular to the face are relatively stiff.

The center of curvature of the face-engaging portion is preferably located nearer to the free edge of the flap 4d than to the attached edge, so that the flap will be more easily pivoted about the hinge by the pressure of the face. However, the flap also extends far enough beyond that center of curvature so that the edge of the flap will never contact the face. Such an edge contact would constitute a line of high contact pressure, and is very undesirable.

The radius of curvature of the face-engaging flap should be at least of the order of one-half inch and may be as great as one inch or so. These limits are not rigid, but if the radius is too small, the pressure between the flap and the face will be increased and will create discomfort. Too large a radius might shift the region of contact between the flap and the face to an area which is more sensitive to pressure, for instance, across the nose, it might create pressure on a sensitive area located downward along the nose from the bridge.

By virtue of the convex face-engaging surface of the flap 4d and the hinge structure 4e, the pressure between the flap and the face may be maintained at a minimum while nevertheless insuring a firm positive contact which effectively seals the space between the face and the window 3 against the entry of dirt or other airborne foreign substances.

The lower transverse frame member 5, as best seen in Fig. 3, comprises a vertically extending frame portion 5a generally similar in structure to the vertically extending frame portion 4a but considerably narrower. The frame portion 5a is provided in its upper surface with a groove 19 to receive the lower marginal portion of the window 3. The frame member 5 also has an inwardly extending flange 5c corresponding generally in structure and function to the flange 4c and joined at its inner end to a downwardly projecting flap 5d which corresponds generally in structure and function to the flap 4d. A crease or other suitable hinge connection 5e may be provided at the connection between the flap 5d and the flange 5c.

The flaps 4d and 5d and flanges 4c and 5c may assume various angular positions as required to adapt themselves to various facial contours on which they may be used. This adaptation is shown by the various dotted line positions in Fig. 3, representing three different profiles with which the device may be used.

There is shown in Fig. 4 a portion of the lower transverse frame member 5 over the cheek of the wearer. Since the variations in facial structure encountered on the cheek are considerably greater than those encountered

at the forehead and nose, the flange 5c is made more flexible at that point by providing another hinge 5f at the connection between the flange 5c and the vertical frame portion 5a. As in the case of the hinge 5e, the hinge 5f may consist of a crease or other weakened portion of the connection between the frame portion 5a and the flange 5c.

The side frame members 6 are best shown in detail in Fig. 5. These frame members comprise horizontally extending portion 6a having a recess 20 adapted to receive a side marginal portion of the window 3, an outer rearwardly projecting flange 6b adapted to engage the helmet shell and an inner rearwardly projecting flange 6c. The inner end of the flange 6c is joined to a flap 6d which is adapted to engage the wearer's face in a manner similar to the flaps 4d and 5d.

The flange 6b corresponds generally in structure and function to the flange 4b on the upper transverse frame member 4. The flanges 4b and 6b are integrally connected at the upper corner of the frame as clearly shown in Fig. 1. The side frame member 6, is adapted to fit against the grommet 18 around the rim of the helmet shell, as shown in Fig. 5. The flange 6b extends only about half way down the side frame member 6, and tapers from a substantial width at the top down to nothing at the point where it crosses the rim of the helmet 1.

Fig. 5 shows, at opposite sides of the figure, alternative forms of construction of the side frame members. The structure described above appears at the left-hand side of Fig. 5. At the right-hand side there is shown an alternative structure in which the side frame member is indicated generally by the reference numeral 39. This frame member includes an outer flange 39b which may be the same as the flange 6b described above. The inner flange is constructed somewhat differently and comprises a short fold or pleat 40 joined to the edge of the main frame member 39 and another fold or pleat 41 extending between the fold 40 and a face-engaging flap 38 which may be the same as the flap 6d. The use of the two folds or pleats 40, 41 provides a slightly more resilient structure than the use of the single fold or flange 6c.

The face-engaging flaps 4d, 5d and 6d, are joined integrally at the corners of the eye shield, and together form a continuous band which sealingly engages the face of the wearer along a path which completely encircles his eyes. That band extends across the forehead, downwardly and rearwardly across the temples, back across the cheeks and over the nose. The structure shown readily adapts itself to a wide variety of facial contours, and always provides an effective seal along the entire length of the path just described, without being uncomfortable and without exerting more than a light pressure against the wearer's face at any point along that path.

Fig. 6 illustrates one form of mechanism for ventilating the space between the wearer's eyes and the window 6. As there shown, the lower transverse frame member 5 is provided in its rear face with an aperture 21 which communicates with a vertically extending aperture 22 along the back wall of the groove 19. The communicating apertures 21 and 22 provide a path for air to enter the space between the window 3 and the wearer's eyes, as indicated by the arrows in the drawing.

The upper transverse frame member 4 is provided with a similar aperture 23 opening at its rear face and communicating with an aperture 24 located along the back wall of the groove 19. The communicating apertures 24 and 23 allow air to pass out of the space between the wearer's eye and the window 3 and move into a chamber 38 between the transverse frame member 4 and the helmet shell 1. The flange 4b of the transverse frame member 4 is provided with a number of apertures 25 which vent the chamber behind the frame member 4 to the atmosphere, thereby providing a complete path for circulation of air through the space between the wearer's eyes and the window 3. That space is therefore, adequately ventilated so that heat and moisture appearing therein may be carried out to the atmosphere.

The apertures 21 and 22 are preferably located at the lowest part of the frame member 4. They should always be located below the eyeball, which is the chief source of moisture behind the eye shield.

The chamber 38 between the frame member 4 and the shell 1 provides a further safety feature under certain conditions of use. Those conditions are found, for example, when the eye shield is used in a crop-dusting airplane, for which use the dust-proof eye shield of the present invention is particularly suited. Crop dusting work is in many cases done in open cockpit aircraft. In any type of aircraft, the pilot frequently has to lean out the cabin window to observe conditions behind and below him. Such a movement typically subjects the windward side of the eye shield to a stream of high velocity air, building higher pressure at the entrance of ventilation channels. This high pressure propagates through the channels to the inside space between the face and the shield. Outside the shield, the pressure may be low due to the curvature of the lens substantially parallel to the airstream.

This pressure difference tends to lift the shield away from the face. When a conventional eye shield is used, the pressure difference between the external low pressure and the high pressure inside the shield tends to aid the high velocity stream in tearing the shield away. However, in the shield of the present invention, the chamber 38 then serves as a pressure equalizer. If one corner of the shield is subjected to low external pressure, additional air is drawn through the apertures 25 near that end of the shield, while the flow through some of the other apertures 25 is reversed, so that they supply some of the additional air flow required by the chamber 38. The pressure within chamber 38 drops sufficiently so that the tendency for the eye shield to lift away from the helmet is reduced.

Fig. 7

This figure illustrates an alternative arrangement of venting apertures, in which the straight ventilation aperture 24 of Fig. 6 is replaced by a zigzag ventilation channel 42. The structure shown in Fig. 7 is otherwise similar to that shown in Fig. 6.

Fig. 8

This figure illustrates a modified form of arrangement of the ventilating channels, in which the chamber 38 is connected through communicating channels 42 and 43 to the space outside the window 3, and through another channel 44 to the space inside the window. This tends to equalize the pressure inside and outside the window, particularly if the shield is worn in a situation where it is subject to the impact of high velocity air.

Fig. 9

This figure illustrates a modified form of eye shield generally indicated by the reference numeral 27 and having an upper transverse frame member 28 provided with an inner flange 29 which is joined to a flap 30. The flap 30 is similar in function to the flap 4d of Fig. 3 and the flange 29 is similar in function to the flap 4c of Fig. 3.

Flange 29 is modified in a manner similar to the flange 40, 41 at the right-hand side of Fig. 5, in that it is divided into two folds or pleats 29a, 29b, providing greater flexibility of the flange and hence a wider range of adaptation to variations in facial contours.

The lower transverse frame member 5 is provided with inwardly extending flange 5c joined at its inner end to a downwardly projecting flap 5d which corresponds generally in structure to the flap 30.

Figs. 10 to 13

These figures illustrate a modified form of eye shield embodying certain features of the invention and adapted to be worn without a safety helmet. The eye shield shown in these figures may, of course, be worn with a safety helmet providing the safety helmet structure is such that there is no interference between the parts.

The eye shield of these figures includes a window **31** and a frame consisting of an upper transverse frame member **32**, a lower transverse frame member **33** and side frame members **34**. Anchor plates **35** are attached by means of rivets **36** to the side frame members **34**. The anchor plates **35** may receive a mounting strap or straps of any suitable construction, which may, for example, be a single adjustable strap extending around the back of the wearer's head. The upper frame member **32** is provided with a groove **37** in its lower surface to receive the upper marginal portion of the window **31**. The frame member **32** has an inwardly projecting flange **32***a* whose inner end joins a flap **32***b*. As in the case of the flap **4***d*, the flap **32***b* is provided with a convex face engaging surface and is connected to the flange **32***a* at a weakened hinge **32***e* which allows the flap **32***b* to pivot readily about that hinge so that the pressure of the flap **32***b* against the face is minimized.

The lower transverse frame member **33** is provided with an inwardly projecting flange **33***a* which is joined to a flap **33***b* generally similar in structure and function to the flap **32***b*. The side frame members **34** are also provided with rearwardly projecting flanges **34***a* joined to face engaging flaps **34***b* generally similar in structure and function to the flap **32***b*. The flange **33***a* is made wider along the cheek engaging portion, as shown in Fig. 13, to accommodate wider variations in facial contours encountered at that point.

As in the case of the frame illustrated in Figs. 1 to 6, the frame of Figs. 10 to 13 is preferably molded in a single piece of rubber or other similar material which may be readily flexed to fit the face of the wearer.

While I have shown and described certain preferred embodiments of my invention, other modifications thereof will readily occur to those skilled in the art, and I therefore intend my invention to be limited only by the appended claims.

I claim:

1. An eye shield adapted to be worn with a safety helmet comprising a window, a frame encircling said window, said frame including a transverse member having a portion adapted to engage the forehead rim of a helmet and extending upwardly from said portion, and a flange of flexible resilient material attached to the upper edge of said frame member and having a normal unstressed position in which it extends rearwardly therefrom, said flange being adapted to engage at least at its rearmost edge the outer surface of said helmet at a locality spaced upwardly from the forehead rim thereof, said helmet engaging flange being resiliently bendably movable about its attachment to the frame and adapted thereby to conform throughout its length to helmets of varying sizes and shapes, and means adapted to mount said shield on a helmet.

2. An eye shield adapted to be worn with a safety helmet comprising a frame, a window in said frame, means attached to said frame about the entire periphery of the window and adapted to engage the face of a wearer across the forehead, temples, cheeks and nose, helmet engaging means attached to said frame at the upper side of said window and adapted to engage a helmet on the head of a person wearing the eye shield, and mounting means adapted for mounting said shield on said helmet, said face-engaging means including a flange attached to the frame and extending rearwardly therefrom, and a flap of flexible resilient material attached along one edge to said flange and extending at an angle therefrom to a free edge, at least a portion of said flap being adapted to engage a face, a first articulation connecting the flange and the frame to permit bending movement of the flange with respect to the frame, and a second articulation connecting the flange to the flap to permit bending movement of the flap with respect to the flange, said face-engaging portion of the flap having an arcuate cross-section convex on its face-engaging side and having the center of curvature of said arcuate face-engaging portion located nearer to the free edge of the flap than to said one edge, said flap and flange having substantial flexibility in a direction perpendicular to the face-engaging portion of the flap and substantial resistance to deformation in a direction parallel to the face-engaging portion of the flap, said mounting means including first and second strap means, said first strap means being adapted to connect the lower side of said frame to the helmet and adjustable to vary the contact pressure between the lower portion of said face-engaging means and the wearer's cheeks and nose and effective upon adjustment thereof, while the shield is mounted on the wearer's face, to bend said flap and said flange about the respective articulations and to vary the contact pressure between the face and said face-engaging portion of the flap, said second strap means being adapted to connect the upper side of the frame to the helmet and adjustable to vary the contact pressure between the helmet engaging means and the helmet, said first and second strap means being independently adjustable with respect to each other.

References Cited in the file of this patent

UNITED STATES PATENTS

1,949,595	Willson et al.	Mar. 6, 1934
2,074,219	Hofstotter	Mar. 16, 1937
2,762,051	Finken	Sept. 11, 1956

FOREIGN PATENTS

847,458	France	July 3, 1939
937,207	France	Mar. 1, 1948
54,416	France	Oct. 24, 1949
698,614	Great Britain	Oct. 21, 1953

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,936,458

May 17, 1960

August G. Luisada

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 33, for "C." read -- S. --; column 6, line 29, for "high" read -- higher --.

Signed and sealed this 4th day of April 1961.

(SEAL)

Attest: ERNEST W. SWIDER

XXXXXXXXX

Attesting Officer

ARTHUR W. CROCKER

Acting Commissioner of Patents