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R.F. SHIELDING GOGGLES AND HELMET

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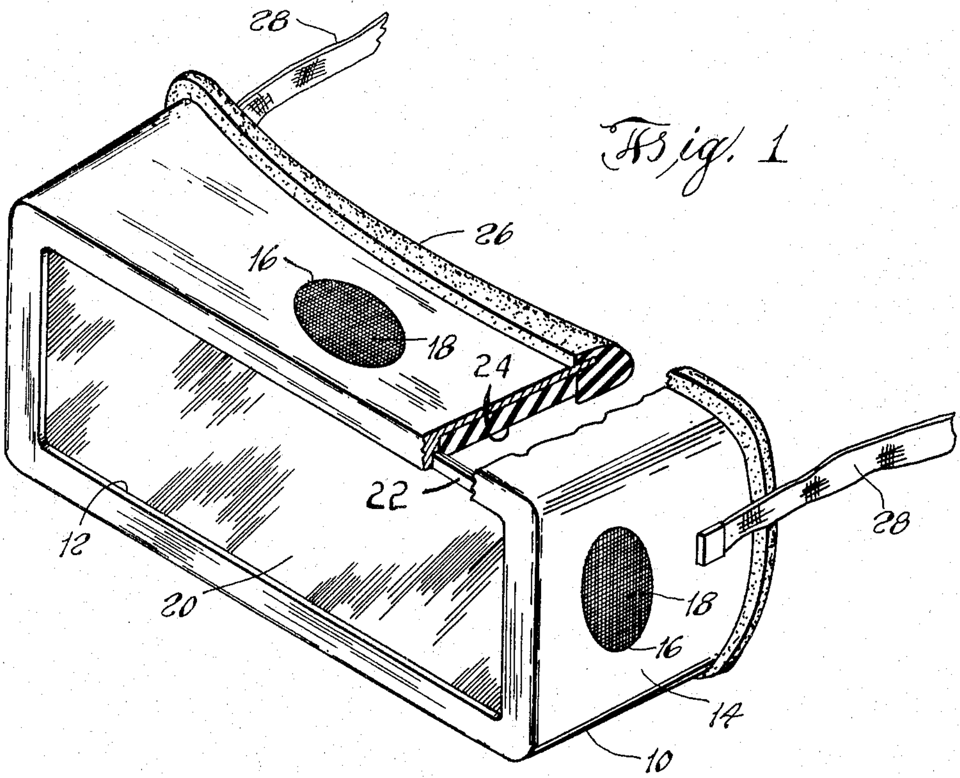

Fig. 1

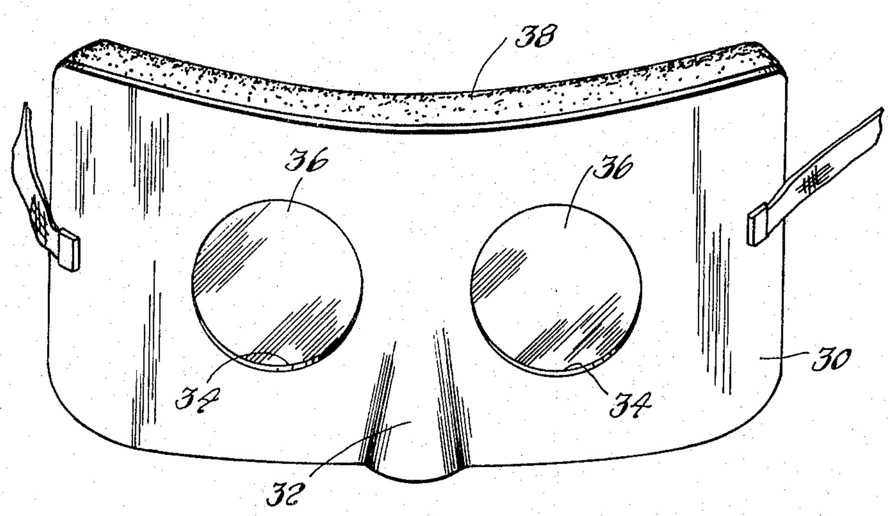

Fig. 2

INVENTORS.
CHARLES CHRISTIANSON
RICHARD J. MORSS
BY Arthur L. Bowers
AGENT
John R. Pease
ATTORNEY.

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R.F. SHIELDING GOGGLES AND HELMET

Charles Christianson and Richard J. Morss, New York, N.Y., assignors to the United States of America as represented by the Secretary of the Navy

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4 Claims. (Cl. 2—14)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties theron or therefor.

This invention relates to shielding the eyes and head against hazardous radio frequency (R.F.) radiation, including microwave radiation, for use by personnel that have tasks to perform in environments where these hazards are present.

Information has been developed on the effects of high intensity R.F. radiation on the human body; R.F. radiation can cause physiological changes in the eye tissue that can mature into cataract-like obstructions long after the exposure and can cause tissue damage in the head. The permissible exposure limit to R.F. established in the United States for total body irradiation in terms of field intensity is 10 milliwatts per square centimeter. In the U.S.S.R., which has established lower limits, there are regulations to the effect that radiation intensity in areas where personnel are required to be present should not exceed the following maximum permissible values:

(a) In the case of irradiation during the entire working day—no more than 0.01 milliwatts per square centimeter intensity.

(b) In the case of irradiation for no more than two hours per working day—no more than 0.1 milliwatts per square centimeter intensity.

(c) In the case of irradiation for no more than 15 to 20 minutes per working day—no more than 1.0 milliwatts per square centimeter intensity. In this case the use of protective goggles is mandatory.

In the military services particularly, though in the civilian sphere also, there are tasks to be carried out by personnel in the vicinity of high-powered operating radars and in other areas wherein the combination of intensity of the R.F. field in the environment and the time to be spent in that environment is above the limits described above. Absolute restrictions against entry into such potentially hazardous areas are not feasible.

Significant damage to the eyes and head which are among the most susceptible portions of the body can result from irradiation by hazardous intensity R.F. depending upon the frequency. Injuries from exposure to these fields may manifest themselves as an erythema of the skin, deep tissue heating within the head, and/or cataract formation in the eyes. The depth of penetration and the percentage absorption of the energy in the human body varies with the frequency of this radiation. Above 3 gigacycles, the human body absorbs approximately 50% of the incident radiation most of which is transformed into heat in the skin. Of the R.F. energy between 1 and 3 gigacycles incident to the human body 20%–100% is absorbed, and depending upon the frequency, is divided between the skin and deeper tissues. Most of the energy below one gigacycle absorbed is transformed into heat in the deeper tissues of the body. In other words, R.F. radiation incident to the human body can cause two entirely different effects, namely, surface heating which concerns eye tissue, and/or deep tissue heating, the predominant effect being a function of frequency. Above 3 gigacycles it is essential that the eyes be shield from hazardous intensity R.F. Shielding the eyes against R.F. below 1 gigacycle is of minor significance and shielding the eyes against R.F. between 3 gigacycles and 1 gigacycle decreases with decreasing frequency from essen-

tial to doubtful or minor significance. The importance of shielding the entire head increases progressively with decreasing frequency below 3 gigacycles.

Gogles have been available for shielding the eyes against R.F. radiation but they have too high a level of light attenuation, they permit radiation to leak behind the goggles edgewise and because the interior of the prior art goggles reflect radiation whereby radiation reaches the eye after reflection off the inner surface of these goggles. There has been no R.F. shield for the entire head.

An object of this invention is to afford protection against R.F. hazardous to the eyes and deeper tissues of the head, with minimal interference to viewing.

A further object is to provide eye protection means and/or head protection means against hazardous R.F. radiation having minimal leakage.

A further object is to provide eye protection and a head protection means against hazardous R.F. with minimal interior reflectivity.

A further object is to provide an easy to use, safe, relatively, low-cost device generally superior to prior art devices for eye protection against hazardous R.F. radiation.

Other objects and advantages will appear from the following description of an example of the invention, and the novel features will be particularly pointed out in the appended claims.

FIG. 1 is a perspective view partly cut away of one embodiment of this invention, and

FIG. 2 is a perspective view of another embodiment of this invention.

R.F. goggles according to this invention include a frame highly reflective to R.F. radiation, lined with one of various commercially marketed soft sponge-like resilient R.F. absorber materials and outfitted with a lens embodying materials and structural arrangements that have been used in conducting windshields of airplanes and other vehicles.

More particularly, the embodiment shown in FIG. 1 includes a frame **10** that may be rigid or flexible provided that it has good surface conductivity. For example, the frame may be a good conductor sheet metal or any sheet metal with a good conductor electroplated thereon, shaped to form a box-like goggle frame with a viewing opening **12** as shown in FIG. 1. Alternatively, the frame may be of a rigid or yieldable plastic, or an elastomeric material, coated over the entire surface inside and outside with an essentially continuous layer of good conductor; the coating may be a silverizing preparation, conductive paint, metallic film, etc. applied liberally by various techniques including painting, spraying. The frame has several ventilation openings **16**. A fine metal screen **18** of good conductor extends completely across each of the openings **16** and is secured with conductive cement, high conductivity solder, etc. to the conductive frame all around each opening for low resistance contact with the conductive frame. The metal screens permit air circulation and do not reduce the R.F. attenuation characteristic of the frame if the holes in the screen are small enough with respect to the frequency of the R.F. field in which these goggles will be used. A transparent conductive lens **20** is seated in and cemented to the frame with conductive cement all around the periphery of the opening. The frame may be provided with a recess or lens retaining means to assist the cement to retain the lens in the frame. The lens includes a base of a transparent plastic or glass supporting a continuous conductive film across one or both faces or includes two plastic or glass laminae sandwiching a layer of conductive film. The density of the conductive film is selected for the attenuation desired consistent with light transparency requirements. It is desirable that the lens have a resistivity no more than five ohms per square for providing a minimum of 25 db attenuation and a light transmittance of 70%. This combination is obtainable by use of Sierracote 3, a product of Sierracin Corp. of Burbank, Calif., for the conductive film. A conducting stripe **22** of a conductor material extends completely around the periphery and is electrically connected to the conductive film and of substantially greater thickness than the film to facilitate electrical connection thereto. Conducting cement provides good electrical contact between the stripe and the frame all around the lens. Sponge-like, soft R.F. absorber material **24** lines the interior of the frame except for the lens opening and the ventilation openings. It is secured in place with conductive cement which is sandwiched between and essentially continuous between the absorber material and the frame. A channel **26** of the R.F. absorber material, that may or may not be preformed, seats the entire edge of the open end of the frame, continuously all around and is secured to the frame all around with conductive cement. The goggles are provided with a conventional headband **28**.

The lens is made of the materials and by the techniques used for making conductive windshields and is obtainable from the same sources. It is preferable that the conductive film(s) be as thick as practical consistent with transparency requirements which, in turn, depends upon the available lighting. Lenses as described may be ordered from the commercial suppliers of conducting windshields. One example of a commercial supplier is the Sierracin Corp. of Burbank, Calif., which is the assignee of a number of United States patents concerning conductive windshields, e.g. #2,991,207 and #3,041,436. Sponge-like, soft, R.F. absorber material is marketed commercially in sheet form. One example of a suitable material is Eccosorb (e.g. Eccosorb LS–26) marketed by Emerson and Cuming of Canton, Mass., and described in their technical bulletin 8–2–11.

This invention is not dependent upon the specific products of the specific suppliers named above. Comparable products are available from other sources.

The embodiment of the invention shown in FIG. 2 includes a frame **30** of good conductor sheet metal or metal coated plastic as described for the embodiment shown in FIG. 1. The frame material is somewhat curved with a portion **32** shaped for the nose in the manner of a party mask and has two lens openings **34**. Two lenses **36** of conducting transparent material as described above for the embodiment in FIG. 1 and having a conductive stripe, not shown, are secured to the inner face of the frame to extend across and completely close the openings **34**. The peripheral stripe portions of the lenses are cemented to the frame all around the openings with conductive cement. Alternatively, the lenses are assembled in mounting rings. The mounting rings are screwed into place with a conductive gasket to insure good contact all around the lens opening. Sponge-like, soft, resilient R.F. absorber material **38** in sheet form having two cutouts for alignment with the lens openings are cemented to the inner face of the frame with a substantially continuous layer of conductive cement. This embodiment lends itself to interchangeable lenses, a rigid solid frame, and readily changeable absorber. Consequently this goggle can be altered on site to meet the existing conditions of frequency, power and visible light. A thick metal frame provides attenuation in excess of 50 db. The flexible absorber can be of various thicknesses to cover frequencies from K band (10.5 gigacycles per second to 40 gigacycles per second) all the way down to the UHF region (300 megacycles per second to 3 gigacycles per second).

R.F. generally refers to the band from 30 kilocycles per second to 300 megacycles per second; in this case, R.F. is used in a more comprehensive sense to cover 30 kilocycles per second to 40 gigacycles per second.

Though the attenuation, resistance to leakage, and reflection characteristics vary with the choice of absorber material, the thickness of absorber material and the frequency of the radiation shielded against, substantial improvement in shielding is achieved over prior art goggles by the described combination and arrangement of elements.

Another embodiment of the invention is a helmet, not shown, large enough to slip over the head and extend to the neck or shoulders to protect the entire head; the helmet includes lenses and absorber lining as in FIG. 2 and assembled in a metal frame in the shape of a helmet for the entire head.

It will be understood that various changes in the details, materials, and arrangements of parts (and steps), which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

We claim:

1. A device for shielding a person's eyes against R.F. radiation comprising

light transmitting lens means including transparent base material supporting a continuous electrically conductive film thereacross,

a continuous electrically conductive peripheral stripe on the light transmitting lens means electrically contacting the conductive film continuously around the periphery and of substantially greater thickness than the conductive film,

an electrically conductive frame seating said light transmitting means therein and continuous around said light transmitting means,

electrically conductive cement between the stripe and the frame and continuous and coextensive with the stripe,

sponge-like, soft, resilient, compressible R.F. radiation absorber material carried by the conductive frame for compression between the frame and the face continuously around said light transmitting means to shield against edgewise leakage of R.F. radiation,

electrically conductive cement between the absorber material and the conductive frame and essentially continuous therebetween, and

a headband for retaining the device in front of the eyes and for compressing the absorber material between the frame and the head of the wearer.

2. A device as in claim **1** wherein

said frame includes a ventilation opening in each side of the frame,

metal screen material across each frame opening and secured to the periphery around each opening with electrically conductive material.

3. A device for shielding a person's eyes against R.F. radiation comprising:

light transmitting lens means including transparent base material supporting a continuous electrically conductive film thereacross,

a continuous electrically conductive stripe around the periphery of the light transmitting lens means electrically contacting the conductive film continuously around the periphery, and of substantially greater thickness than the conductive film,

an electrically conductive frame seating said light transmitting means therein and continuous around said light transmitting means,

electrically conductive cement between the stripe and the frame and continuously coextensive with the stripe,

sponge-like, soft, resilient, compressible R.F. radiation absorber material lining the interior of the frame continuously around said light transmitting means,

electrically conductive cement between the absorber material and the conductive frame and essentially continuous therebetween, and

a headband for retaining the device in front of the eyes and for compressing the absorber material between the frame and the head of the wearer.

4. A device as in claim 3 wherein said frame is a face mask-like rigid frame of conductive sheet metal.

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JORDAN FRANKLIN, *Primary Examiner.*

J. R. BOLER, *Assistant Examiner.*