

[54] HELMET TRANSCEIVER ASSEMBLY FOR A FIREMEN'S HELMET ASSEMBLY OR THE LIKE

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[57] ABSTRACT

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A helmet transceiver assembly for a firemen's helmet assembly or the like which can be mounted in commercially available helmet assemblies. The helmet transceiver assembly includes a mounting structure which is adapted to be disposed within a helmet assembly between the helmet and the helmet suspension system by the structure that mounts the helmet suspension system within the helmet. The helmet transceiver assembly includes a support structure having a crown shaped portion mountable between the helmet suspension system and the helmet of a conventional helmet assembly, and fore-and-aft downwardly and outwardly extending depending portions which are adapted to be disposed in close proximity to the brim of the helmet, the downwardly and outwardly extending portions carrying controls and a microphone and a power pack for a radio receiver and transmitter mounted upon an upper central portion of the crown portion of the support structure.

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[51] Int. Cl. H04b 1/38

[58] Field of Search 325/16, 118, 361

[56] References Cited

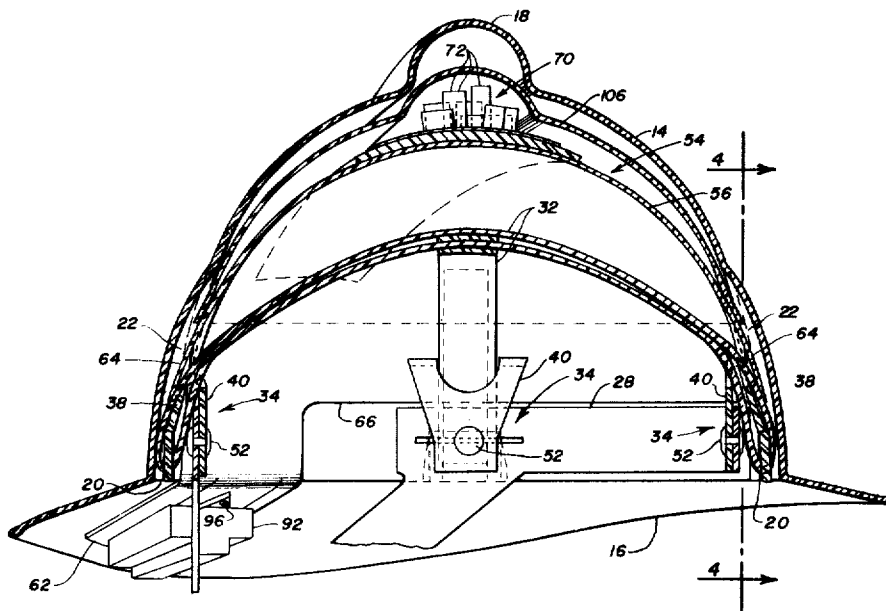
UNITED STATES PATENTS

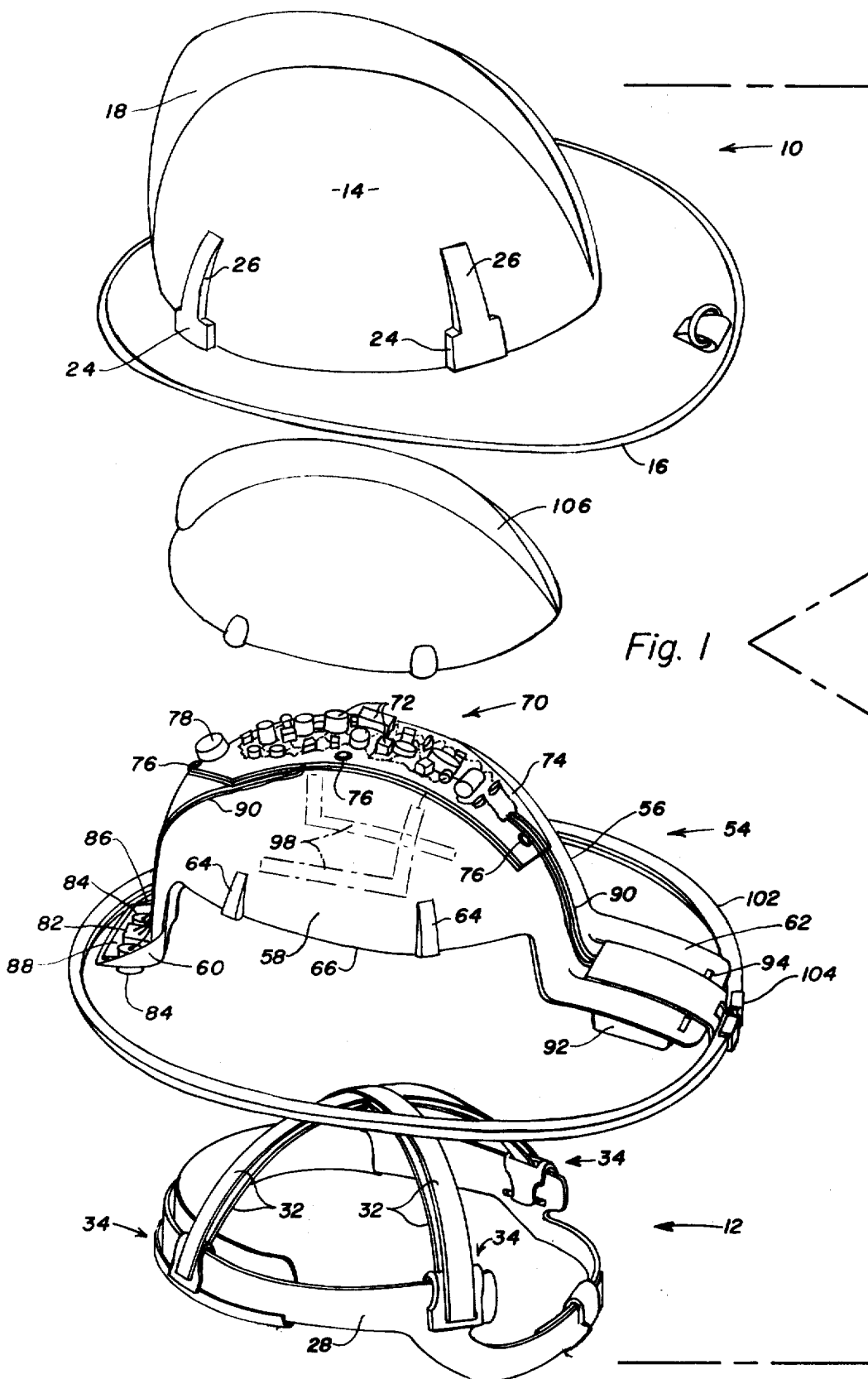
3,549,831	12/1970	Forney	325/118 X
3,586,977	6/1971	Lustig et al.	325/16

FOREIGN PATENTS OR APPLICATIONS

740,988	8/1966	Canada	325/16
360,932	10/1935	Italy	325/16

18 Claims, 8 Drawing Figures





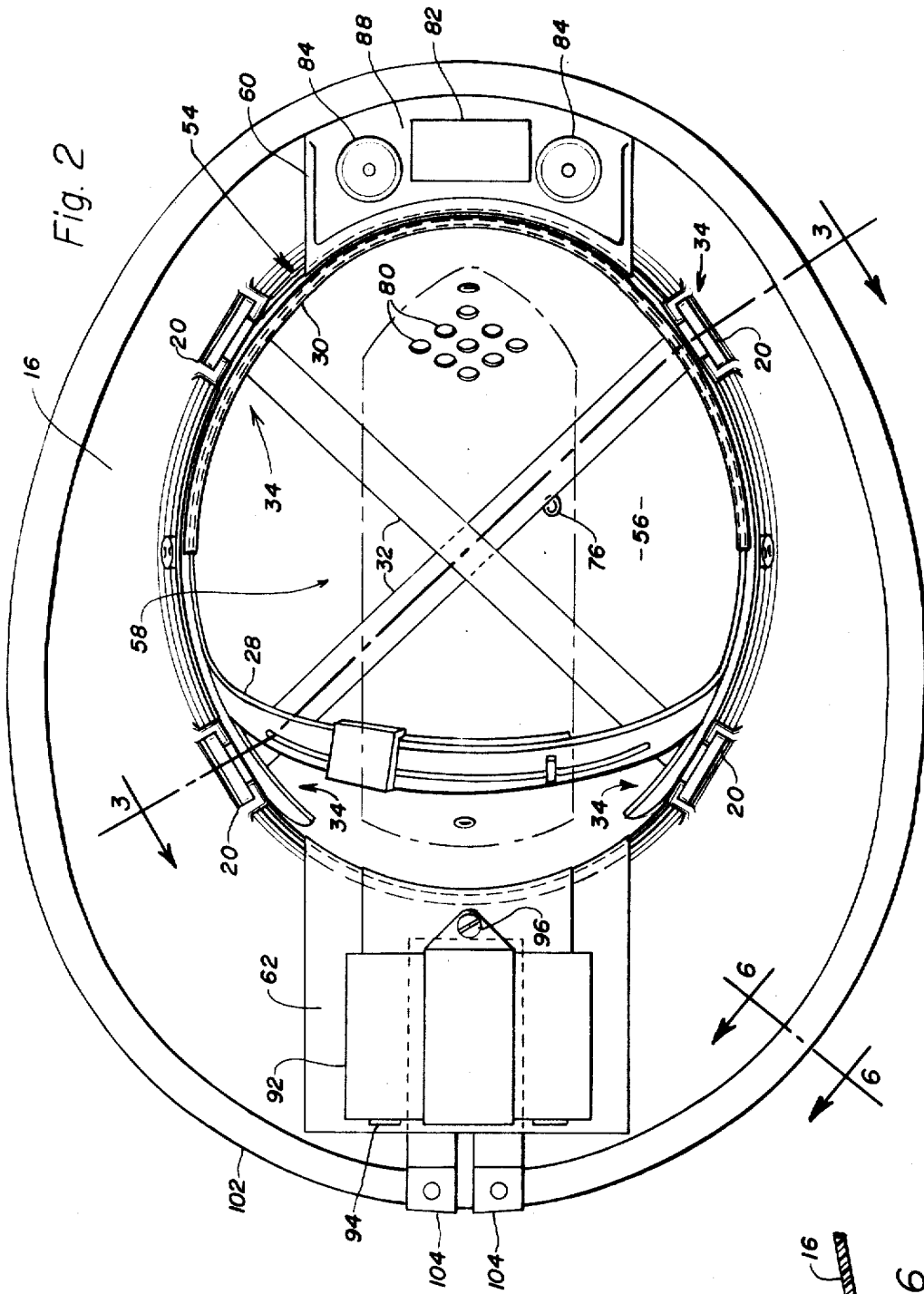


Fig. 2

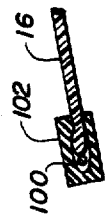
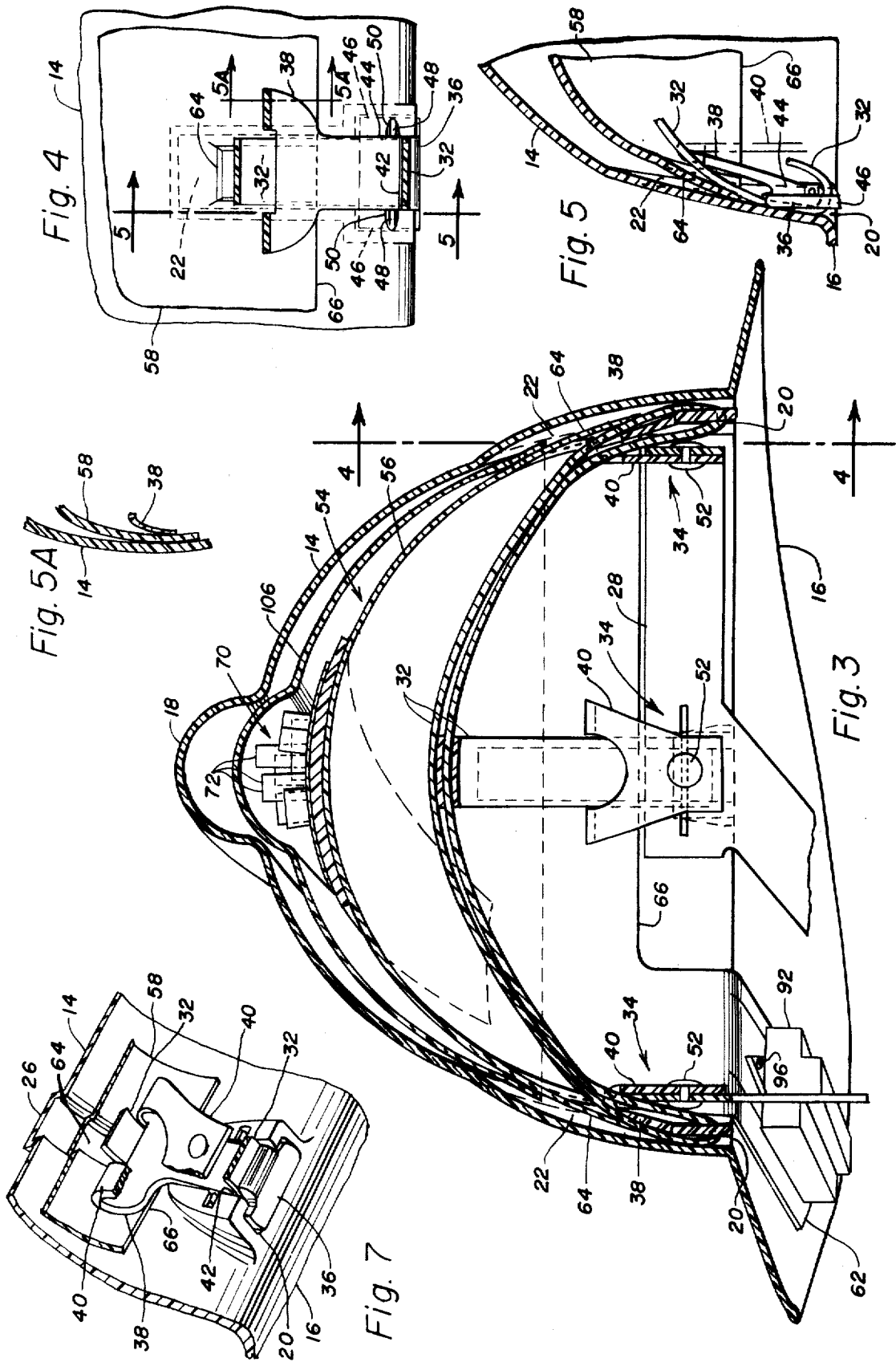


Fig. 6



HELMET TRANSCIVER ASSEMBLY FOR A FIREMEN'S HELMET ASSEMBLY OR THE LIKE

FIELD OF THE INVENTION

The present invention relates generally to self-contained transceivers, and more particularly to a self-contained transceiver that can be mounted within a conventional protective headgear such as a firemen's helmet assembly or the like without modification of the headgear.

BACKGROUND OF THE INVENTION

In the past it has been proposed to provide protective headgear of various types with a radio receiver and transmitter. Such prior art devices have generally taken one of three forms. A first form is a microphone and speaker or ear piece which is worn below the protective headgear and which is in turn connected by an umbilical cord to either a power pack or a combination unit which may include a radio receiver, a radio transmitter, power pack and antenna, the power pack, or combination unit being carried by the body of the wearer of the helmet assembly. A representative form of this type of transceiver is shown in U.S. Pat. No. 3,610,841 issued Oct. 5, 1971. This form has the disadvantage that it has umbilical wires and external connections which may become entangled with immovable objects as the wearer of the helmet assembly moves about, and also has the disadvantage of requiring a substantial amount of time in mounting the head set and connecting it to its outside power pack, etc. A second form is a completely self-contained head gear having a built-in transceiver, antenna, speaker, microphone, and controls. A representative example of this type is shown in U.S. Pat. No. 3,218,607 issued Dec. 10, 1962, and also in the COMRAD FH-1 two-way radio helmet assembly manufactured by the International Signal and Control Corporation. In this form it has been the practice to build a self-contained transceiver assembly into a specially designed helmet. This has the disadvantages of requiring a specially designed helmet and the further disadvantage in that the transceiver assembly cannot be interchanged with other existing helmets. This is particularly disadvantageous when the protective helmet assembly is provided with identifying data as is common with fire helmets and the like, therefore, permitting the use of the transceiver only with the identified helmet within which it is mounted or requiring the identification of the helmet to be changed when different people are utilizing the transceiver helmet assembly. A third form is a composite of the two previously mentioned forms and requires both a specially designed helmet or one which must be modified to receive the transceiver and also utilizes umbilical cords. A typical example of this is shown in U.S. Pat. No. 3,586,977 issued June 22, 1971.

OBJECTS AND SUMMARY OF THIS INVENTION

It is an object of the present invention to provide a self-contained helmet transceiver assembly which overcomes the foregoing disadvantages. More specifically, it is an object of the present invention to provide a helmet transceiver assembly which may be utilized with commercially available helmet assemblies without modification of the helmet assembly, the helmet transceiver being entirely self-contained whereby the helmet

transceiver assembly can be easily installed and removed from existing commercially protective helmet assemblies to allow the transceivers to be implanted from one helmet assembly to another as communication requirements change, whereby the safety aspects of the helmet assembly are improved by improving penetration resistances, and which furthermore provides the wearer with easy access to the transceiver controls without removing the helmet assembly from his head.

Another object of the present invention is to provide a self-contained helmet transceiver assembly for use with a firemen's helmet assembly or the like wherein the transceiver assembly includes a transceiver support having means cooperable with the mounting means of the helmet suspension system of the helmet assembly operable to hold the transceiver support between the helmet of the helmet assembly and the helmet suspension system, the transceiver support having mounted thereon a completely self-contained radio transceiver including a radio receiver, a transmitter, audio components, power pack and controls.

It is a further object of the present invention to provide a self-contained helmet transceiver assembly for use with a firemen's helmet assembly or the like wherein the helmet assembly includes a helmet having a crown portion with spaced apart grooves, and a helmet suspension system which includes upwardly extending relatively resilient portions which are normally disposed adjacent an inner surface of the helmet to either side of each of the spaced apart grooves, the helmet transceiver assembly including a support having a crown portion disposable within the crown portion of the helmet, the crown portion of the helmet transceiver also including a plurality of spaced apart ridges which are adapted to be disposed within the grooves of the helmet to hold the transceiver support in a centered position, the lower portions of the crown portion to either side of the ridges being clamped between the relatively resilient portions of the helmet suspension system and inner portions of the crown of said helmet, the support having mounted thereon a completely self-contained radio transceiver.

Another object of the present invention is to provide a helmet transceiver assembly which can be mounted in a conventional firemen's helmet assembly wherein the overall assembly with the transceiver complies with the American National Standard Institute specification Z-189.1-1969, Class D standard for Firemen's helmets which among other things requires that a spacing between the head straps of the helmet suspension system and top of the helmet be at least one inch in depth.

Another object of the present invention is to provide a transceiver assembly for use in combination with a conventional firemen's helmet assembly or the like wherein the transceiver assembly comprises a high impact plastic liner having a crown portion and front and rear downwardly and outwardly extending portions, the crown portion of the liner being provided with ridges cooperable with grooves within the inner surface of the helmet of the helmet assembly to center the liner within the helmet and the downwardly and outwardly extending portions limiting the upper movement of the liner within the helmet, the crown portion of the liner being held within the crown portion of the helmet by the mounting means for the helmet suspension system.

A further object of the present invention is to provide a transceiver assembly for use with a firemen's helmet assembly or the like having a generally fore-and-aft extending crown ridge on the upper surface of the crown portion of the helmet of the helmet assembly, the transceiver assembly being adapted to be held between the helmet suspension system and the helmet of the helmet assembly by the mounting means for the helmet suspension system, with certain of the components of the transceiver being disposed within the crown ridge of the helmet.

These and other objects and advantages of the present invention are realized by providing a helmet transceiver assembly which can be mounted between the helmet suspension system and the helmet of a conventional firemen's helmet assembly or the like, the helmet transceiver assembly including a support structure having a crown portion and forward and rear generally downwardly and outwardly extending portions which are adapted to underlie the brim of the helmet of the helmet assembly, the crown portion being provided with structure cooperable with the mounting structure of the helmet suspension system to hold the support structure between the helmet suspension system and the helmet, and the support structure having mounted thereon a radio receiver and transmitter which extend into a raised portion of the helmet and forwardly mounted controls on the forwardly extending portion which underlies the brim of the helmet, a power pack carried by the rear downwardly and outwardly extending portion, a speaker mounted on the upper surface of the crown portion of the support structure and in communication with a plurality of apertures in the crown portion to project sound through the support structure, the support structure being of a relatively high impact resistant material to afford additional protection to the wearer of the helmet, and the support structure also having a microphone mounted thereon.

These and other objects and features will be apparent to those skilled in the art after a consideration of the following detailed description taken in conjunction with the accompanying drawings in which a preferred form of this invention is shown.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view showing the helmet transceiver assembly of this invention as it is adapted to be mounted within a conventional firemen's helmet assembly.

FIG. 2 is a bottom view of the assembly shown in FIG. 1.

FIG. 3 is a sectional view taken along the lines 3—3 of FIG. 2.

FIG. 4 is a sectional view taken along the lines 4—4 of FIG. 3.

FIG. 5 is a sectional view taken along the lines 5—5 of FIG. 4.

FIG. 5A is a sectional view taken along the lines 5A—5A of FIG. 5.

FIG. 6 is a sectional view taken along the lines 6—6 of FIG. 2.

FIG. 7 is a perspective view of the structure shown in FIGS. 4 and 5 with parts being broken away for purposes of clarity.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring first to FIG. 1, a conventional firemen's

helmet assembly is shown in these drawings, the firemen's helmet assembly being of the type sold under the trade name of TOPGARD by the Mine Safety Appliances Company. This commercially available type of firemen's helmet assembly includes a helmet, indicated generally at 10, and a helmet suspension system indicated generally at 12. In the following description and in the attached claims reference will be made to upper, lower, forward and rear and equivalents thereof. These references relate to the manner in which the firemen's helmet assembly is normally worn with the helmet transceiver assembly of this invention and is not intended to be limiting in any manner.

The helmet 10 is made of high impact resistant material such as polycarbonate plastic and has a crown portion 14 and a brim 16 which extends outwardly from the lower edge of the crown portion 14. A generally fore-and-aft extending crown ridge 18 is formed on the upper surface of the crown 14, the ridge having a void therein as can best be seen from FIG. 3. Spaced about the lower edge of the crown portion 14 adjacent to the brim 16 are a plurality of spaced apart interior mounting channels 20. Extending outwardly from the mounting channels are a plurality of spaced apart grooves 22, there being one groove for each of the channels 20. In order to provide room for the channels and grooves the outer surface of the crown portion 14 is provided with bosses 24 and ribs 26.

The helmet suspension system 12, which is more fully illustrated in U.S. Pat. No. 3,500,474 is conventionally removably mounted in the helmet 10 to form a helmet assembly. The helmet suspension system includes an adjustable headband 28 which is conventionally provided with a forward sweat band 30, a plurality of headstraps 32 and means for removably mounting the headband 30 and the headstraps 32 to spaced apart portions of the helmet. The mounting means include a plurality of spaced apart mounting members, indicated generally at 34, each of the mounting members including a first portion 36, (FIGS. 4 and 5) which may be removably pressed or force fitted into an associated mounting channel 20, a second portion 38 which is generally resilient and which extends upwardly from the first portion, and a third portion 40 which interconnects the upper edge of the second portion with the headband. The first portion is provided with a generally horizontally extending aperture 42 through which a portion of the headstraps 32 pass as can best be seen from FIG. 4, and the first portion 36 is also provided with an enlarged central portion 44 from which outwardly extending portions 46 extend, the portions 46 carrying detents 48 which are received within notches 50 of the mounting channel 20. The second portion 38 has a generally Y configuration which can best be seen from FIG. 4, the lower portion of the second portion 38 being joined integrally with the upper portion of the enlarged central portion 44 of the first portion 36. This second portion as has been previously noted, is generally resilient and normally lies against spaced apart portions of the helmet to either side of the grooves 22. The third portion 40 is also generally Y-shaped, as can best be seen from FIG. 3, and its upper edge is integrally secured to the upper edge of the second portion 38. It should be noted that the two portions 38, 40, which can be considered to be hinged together, form an aperture through which one of the headstraps 32 passes. The

third portion 44 is in turn secured to the headband 28 by fastener means 52.

The helmet assembly thus far described is generally conventional and by itself does not form part of the present invention. According to the principles of this invention a helmet transceiver assembly indicated generally at 54 is provided, the helmet transceiver assembly being of such construction that it can be easily installed and removed from conventional prior art safety helmet assemblies of the type having a high impact resistant helmet and a removable helmet suspension system without requiring modification to the conventional safety helmet assemblies, the helmet transceiver assembly being completely self-contained within the safety helmet assembly and which furthermore complies with one or more of the various safety codes relating to protective headgear.

In the embodiment illustrated in these drawings the helmet transceiver assembly 54 has a transceiver support in the form of a high impact resistant plastic liner 56, the liner 56 having a crown portion 58 and downwardly and outwardly extending means including a forward downwardly and outwardly extending portion 60 and a rear downwardly and outwardly extending portion 62. Means are provided on the crown portion which are cooperable with spaced apart portions of the helmet for centering the liner within the crown of the helmet, and to this end a plurality of spaced apart ridges 64 are provided, the ridges extending upwardly from the lower side edges 66 of the crown portion 58 and cooperating with the grooves 22 in the helmet to center the transceiver support within the crown of the helmet. The lower side edges 66, which are spaced above the downwardly and outwardly extending portions, cooperate with the mounting means or members 34 and the inner surface of the helmet to hold the liner in place. In this regard it should be noted that the lower edges are wedged or clamped between the second portion 38 of the mounting means 34 and the inner surface of the helmet to either side of the grooves, this feature being best illustrated in FIG. 5A. Thus, it should be appreciated that the mounting means for the helmet suspension system is also utilized to hold the transceiver support within the helmet. It should also be noted that both the forward and rear downwardly and outwardly extending portions underlie the brim 16 and contact the brim to limit the upward movement of the transceiver support 56 within the helmet 10. Thus, a relatively rigid mount for the transceiver support illustrated in the embodiment of the invention is provided by utilizing existing components of a helmet assembly having a removable helmet suspension system.

A self-contained radio transceiver is carried by the transceiver support, the self-contained radio transceiver including a radio transmitter and receiver, indicated generally at 70, the radio receiver and transmitter including a plurality of components 72 mounted upon a relatively narrow elongated flexible printed circuit board 74. The flexible printed circuit board 74 allows the printed circuit board assembly to shape to the curved contour of the plastic helmet liner 56. By utilizing an elongated generally narrow board which extends in a fore-and-aft direction and miniaturized components 72 it is possible to utilize the void in the crown ridge 18 of the helmet 14 to provide additional room for the components so that the desired spacing indicated at S in FIG. 3 between the inner surface of the

top of the crown portion 56 of the liner and the straps 32 can be maintained at not less than 1 inch. The printed circuit board is secured in place on the crown portion 58 of the liner by conventional fastener means 76. A speaker 78 is mounted on the outer surface of the crown portion 58, the speaker being disposed above a circular array of apertures 80.

A microphone 82 and various controls 84 are mounted on the forward downwardly and outwardly extending portion 60. At this point it should be noted that the forwardly and downwardly outwardly extending portions 60 has a raised peripheral edge 86 and a lower intermediate portion 88, the controls being mounted on the lower intermediate portion 88 and extending to both sides of said portion. However, those portions which are above the intermediate portion 88 lie generally below the raised peripheral edge 86 so that the peripheral edge can contact the lower edge of the brim 16 and provide a chamber for the portion of the controls that are disposed above the intermediate portion 88. The controls 84 and microphone 82 are interconnected with the radio receive and transmitter by leads 90 which lie along the upper surface of the crown portion 58. A power pack preferable in the form of a mercury battery (not shown) is mounted within a power pack container 92 which is hinged, as at 94, to the rear downwardly and outwardly extending portion, the power pack container being normally held in a raised position against the lower surface of the downwardly and outwardly extending portion 92 by a screw fastener 96. The power pack is also interconnected with the radio receiver and transmitter by leads 90. Various antenna array may be provided depending upon whether the frequencies utilized by the radio receiver and transmitter are low band or high band. One array consists of two L-shaped antenna strips 98 disposed to either side of the printed circuit board 72 as can be seen in FIG. 1. In another array the antenna 100 (FIG. 6) is mounted within an annular member 102 formed of resilient material and having a C-shaped cross section. The ends of the resilient member 102 are clamped by a member 104 mounted upon the rear downwardly and outwardly extending portion. The member 102 is of such a length that it can be resiliently snapped about the outer edge of the brim 16 of the helmet 10 as can best be seen in FIG. 2.

In order to protect the various components 72 mounted upon the printed circuit board 74 during installation and removal of the helmet transceiver assembly a cover 106 is provided. The cover has a surface which generally conforms to the inner surface of the crown portion 14 of the helmet 10 and is removably secured to the crown portion 58 of the liner 56.

While a preferred structure in which the principles of the present invention have been incorporated is shown and described above, it is to be understood that this invention is not to be limited to the particular details shown and described above, but that, in fact, widely different means may be employed in the broader aspects of the invention.

What is claimed is:

1. A helmet transceiver assembly for use with a firemen's helmet assembly or the like having a high impact resistant helmet and a helmet suspension system removably mounted within the helmet, said helmet having a crown portion and a brim which extends outwardly from the lower edge of the crown, and the hel-

met suspension system including a head band, head straps, and means for removably mounting the head band and head straps on spaced apart portions of the helmet; said helmet transceiver assembly comprising:

a transceiver support including a crown portion adapted to be disposed within the crown of said helmet and downwardly and outwardly extending means adapted to be disposed under the brim of said helmet, and means on the transceiver support cooperable with the mounting means of the helmet suspension system to removably hold the crown portion of the transceiver support generally between the helmet and the helmet suspension system; and

a self-contained radio transceiver mounted upon the transceiver support, said self-contained radio transceiver including a radio receiver, radio transmitter, audio components, power pack, and controls.

2. The helmet transceiver assembly as set forth in claim 1 wherein the downwardly and outwardly extending means include a forward portion and a rear portion, the controls for the radio transceiver being mounted on the forward portion and the power pack being mounted on the rear portion.

3. The helmet transceiver assembly as set forth in claim 1 wherein the transceiver support includes means cooperable with spaced apart portions of the helmet for centering the transceiver support within the crown of said helmet.

4. The helmet transceiver assembly as set forth in claim 3 wherein said last mentioned means comprises a plurality of spaced apart ridges which are adapted to be disposed within a plurality of grooves formed on the interior surface of the crown of said helmet.

5. A helmet transceiver assembly for use with a fireman's helmet assembly or the like having a high impact helmet and a helmet suspension system removably mounted within the helmet, said helmet having a crown portion provided with a plurality of spaced apart grooves which extend upwardly from a lower portion of the crown and a brim which extends outwardly from the lower edge of the crown, and the helmet suspension system including relatively resilient upwardly extending portions which are normally disposed adjacent an inner surface of the helmet to either side of the upwardly extending grooves; said helmet transceiver assembly comprising:

a transceiver support including a crown portion having a plurality of spaced ridges extending upwardly from a lower edge of the crown portion and forward and rear downwardly and outwardly extending portions adapted to be disposed adjacent the lower surface of the brim when said transceiver support is mounted within said helmet assembly, said ridges cooperating with the grooves on said helmet to hold the transceiver support in a centered position, lower portions of the crown portion to either side of the ridges being clamped between the relatively resilient upwardly extending portions of the helmet suspension system and inner portions of the crown of said helmet to either side of said grooves; and

a self-contained radio transceiver mounted upon said transceiver support and including a radio receiver, a radio transmitter, a power pack, audio components, and controls.

6. The helmet transceiver assembly as set forth in claim 5 wherein the forward downwardly and outwardly extending portion has a raised peripheral edge which is adapted to contact a forward portion of said brim and a lowered intermediate portion spaced away from said brim when said transceiver support is mounted within said helmet assembly, said radio transceiver controls being mounted on said intermediate portion with portions of said controls being disposed between said intermediate portion and said brim and other portions of said controls being disposed below intermediate portion.

7. The helmet transceiver assembly set forth in claim 5 wherein the radio receiver and transmitter are mounted on a flexible printed circuit board, said printed circuit board being mounted on an upper surface of the crown portion of said transceiver support.

8. The helmet transceiver assembly set forth in claim 5 wherein the radio transceiver includes an antenna, the antenna, being mounted on the crown portion of the transceiver support.

9. In combination with a firemen's helmet or the like having a high impact helmet and a helmet suspension system, the helmet having a crown and a brim extending outwardly from the lower edge of the crown, the crown having a fore-and-aft extending ridge, a plurality of spaced apart interior mounting channels adjacent the brim which receive mounting portions of the helmet suspension system, and grooves extending upwardly from the mounting channels, the helmet suspension system including a head band carrying a plurality of spaced apart mounting members and a plurality of head straps, each of the mounting members having a first portion engaged within the mounting channel, a second relatively resilient upwardly extending portion which extends upwardly from the mounting channel and which overlies the groove, and a third portion which interconnects the second portion with the head band; the combination therewith of:

a helmet transceiver assembly comprising a high impact plastic liner having a crown portion, front and rear downwardly and outwardly extending depending portions, the crown portion having spaced apart lower side edges spaced above the downwardly and outwardly extending depending portions, and a plurality of spaced apart ridges extending upwardly from the lower side edges, the ridges being disposed in the grooves in said helmet to center the liner within said helmet with the downwardly and outwardly depending portions underlying the brim of the helmet and limiting the upward movement of the liner into the helmet, portions of said liner to either side of said ridges being held in place by a clamping action between the second upwardly extending portions of the mounting members and that portion of the helmet disposed either side of the helmet grooves; and

a self-contained radio transceiver mounted upon said liner, said radio transceiver including a radio transmitter, a radio receiver, audio components, a power pack and controls.

10. The combination set forth in claim 9 wherein the radio receiver and transmitter are mounted upon the upper surface of said liner, the overall width and length of said radio receiver and transmitter being less than the overall width and length of the fore-and-aft extend-

ing ridge on said helmet crown, and said radio receiver and transmitter extending upwardly into said fore-and-aft extending ridge.

11. The combination set forth in claim 10 wherein the distance between the lower surface of the upper portion of the crown portion of the liner and the head straps when in use are greater than one inch.

12. The combination set forth in claim 9 further characterized by the provision of an antenna mounted adjacent the outer periphery of the brim of said helmet.

13. A transceiver safety helmet comprising:

a high impact resistant helmet having a crown and a brim extending outwardly from the lower edge of the crown, the crown having a fore-and-aft extending ridge, a plurality of spaced apart interior mounting channels adjacent to the brim, and grooves extending upwardly from the mounting channels;

a helmet transceiver assembly including a high impact plastic liner having a crown portion mounted within the crown portion of said helmet and front and rear downwardly and outwardly extending portions, the crown portion having spaced apart lower side edges spaced above the downwardly and outwardly extending depending portions and a plurality of spaced apart ridges extending upwardly from the lower side edges, the ridges being disposed within the grooves in said helmet to center the liner within said helmet, and the downwardly and outwardly extending depending portions underlying the brim of the helmet and limiting the upward movement of the liner into the helmet, and a radio transceiver mounted upon the liner and including a radio transmitter and receiver mounted upon the upper surface of the liner and extending upwardly into the ridge of said helmet crown; and

a helmet suspension system including an adjustable head band carrying a plurality of spaced apart mounting members, each of the mounting members having a first portion removably press fitted into the mounting channel of said helmet, a second generally resilient upwardly extending portion which overlies the groove in said helmet and which engages the lower edge of said liner to either side of said ridges to clamp said liner against spaced apart inner portion of the helmet to either side of said grooves, and a third portion which interconnects the second portion with the head band.

14. The transceiver safety helmet as set forth in claim 13 further characterized by the provision of a radio

transceiver cover member mounted upon an upper surface of the crown portion of said liner, said cover member being adapted to protect the components of said radio transceiver.

15. A transceiver safety helmet as set forth in claim 13 wherein the lower side edges of the high impact plastic liner are disposed above the interior mounting channels of the high impact resistant helmet.

16. A helmet transceiver assembly comprising:

a mounting member including a crown and downwardly and outwardly extending fore-and-aft portions, the crown portion of the mounting member having spaced apart lower side edges spaced above the downwardly and outwardly extending depending portions and a plurality of spaced apart ridges extending upwardly from the lower side edges, the forward portions having a raised peripheral edge and a lower intermediate portion;

a radio receiver and transmitter mounted upon the upper surface of the crown portion of the mounting member, the radio receiver and transmitter having a generally narrow configuration;

a speaker mounted upon the upper surface of said crown, said speaker being disposed forwardly of the radio receiver and transmitter and overlying a plurality of apertures within said crown;

a microphone and controls mounted on the intermediate portion of the forwardly and downwardly extending forward portion, said controls having portions disposed above and below the intermediate portions, those portions being disposed above the intermediate portion lying below the upper edge of the peripheral portion; and

a power pack mounted below the lower surface of the rear downwardly and outwardly extending portion.

17. The helmet transceiver assembly set forth in claim 16 further characterized by the provision of an antenna array mounted upon the crown portion of the mounting member to either side of the radio receiver transmitter.

18. The helmet transceiver assembly set forth in claim 16 further characterized by the provision of a generally annular antenna mounting assembly secured to the outer end of the rear downwardly and outwardly extending portion, said generally annular antenna mounting assembly including an annular resilient structure having a C-shaped cross section and an antenna mounted within the C-shaped cross section member.

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