

June 22, 1965

Filed May 13, 1960

J. A. AILEO  
RIGID SHELL HELMET AND RIGGING AND SOUND  
ATTENUATING MEANS THEREFOR

3,190,973

4 Sheets-Sheet 1

Fig. 1.

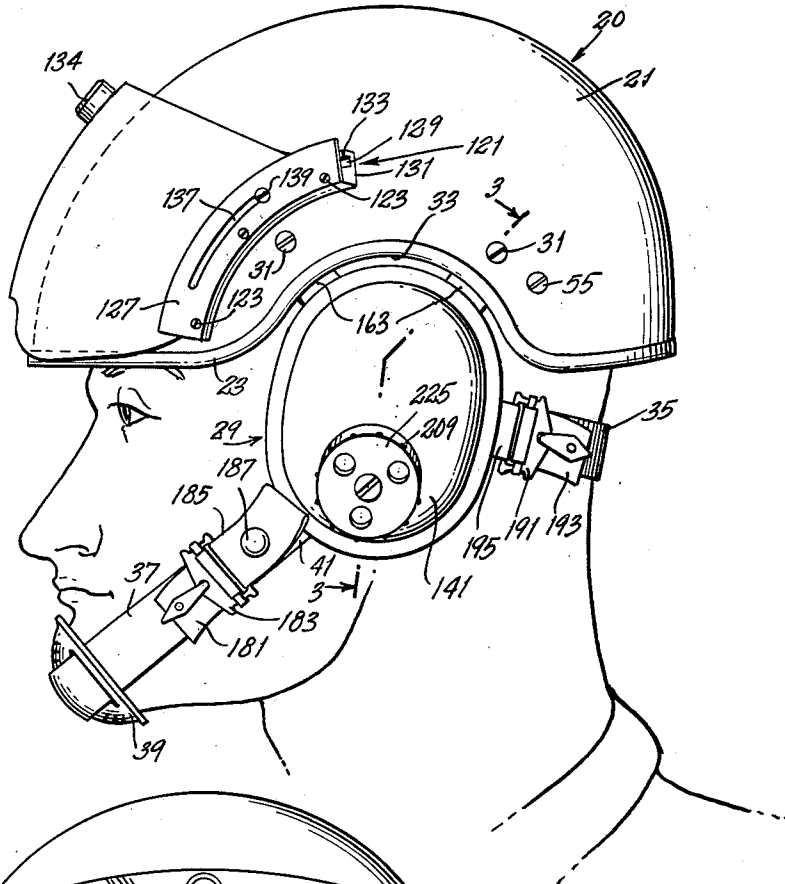
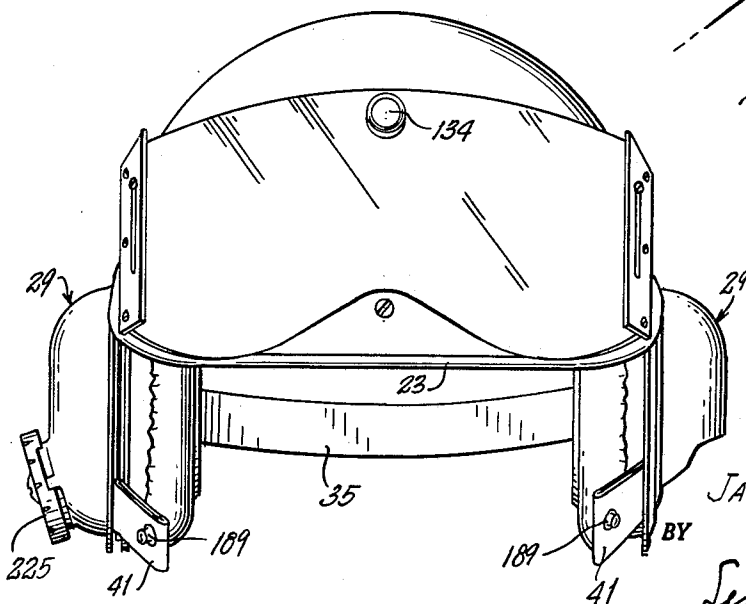


Fig. 2.



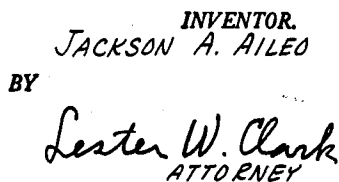
INVENTOR.  
JACKSON A. AILEO

BY  
Lester W. Clark  
ATTORNEY

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Fig. 7.

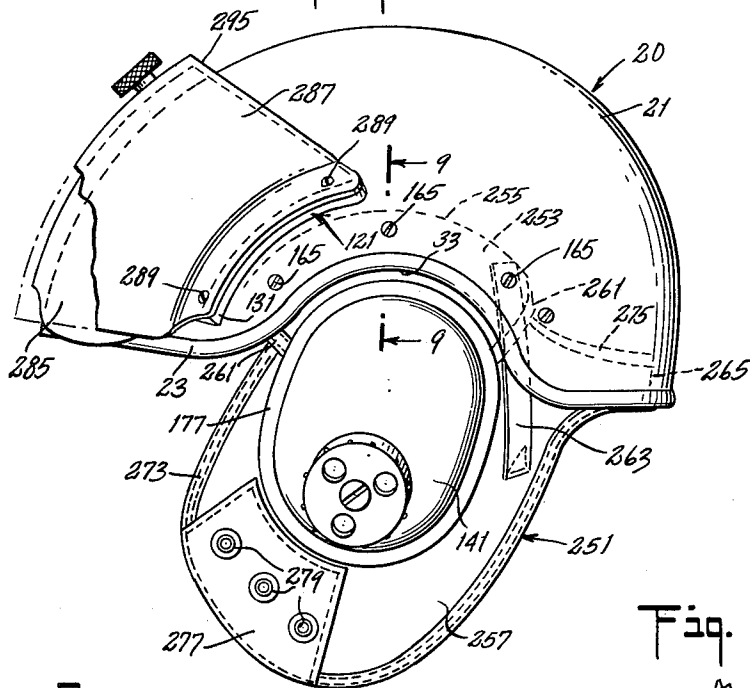


Fig. 8.

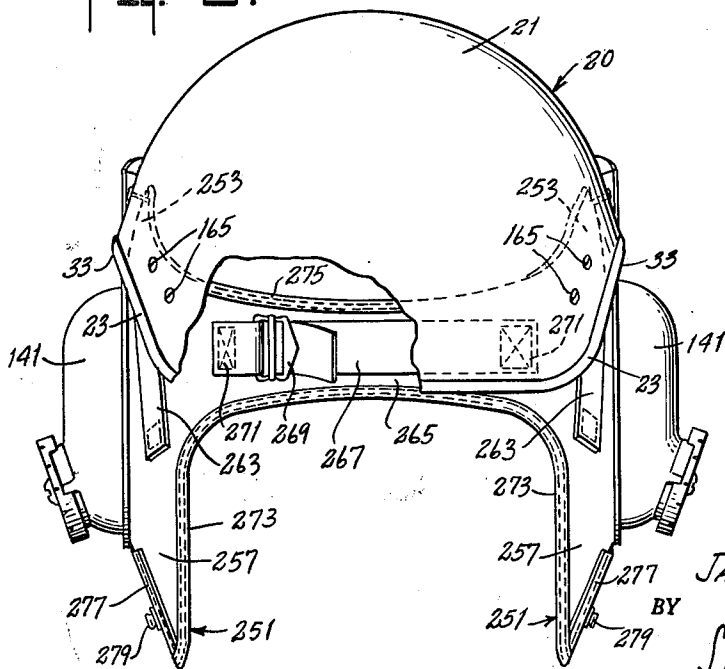
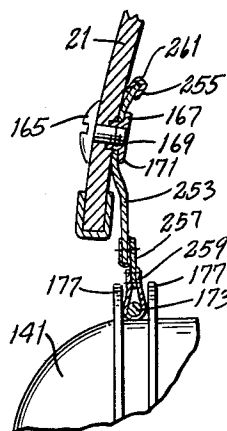


Fig. 9.



INVENTOR.

JACKSON A. AILEO

BY

Lester W. Clark  
ATTORNEY

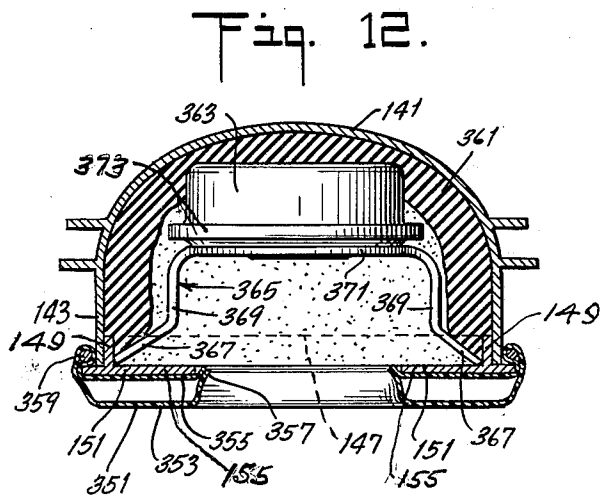
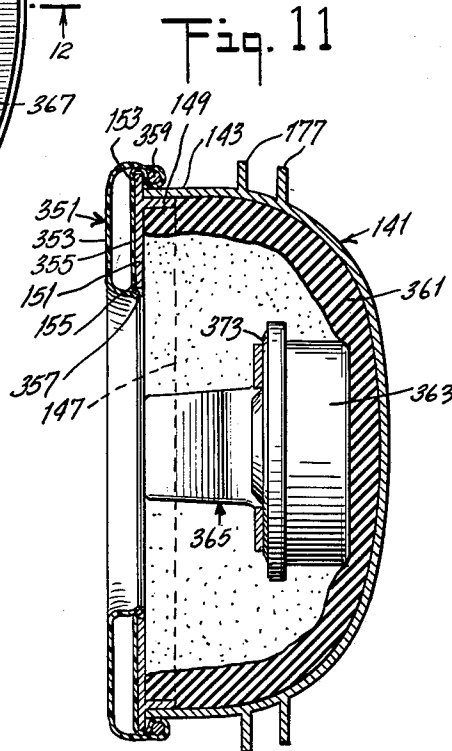
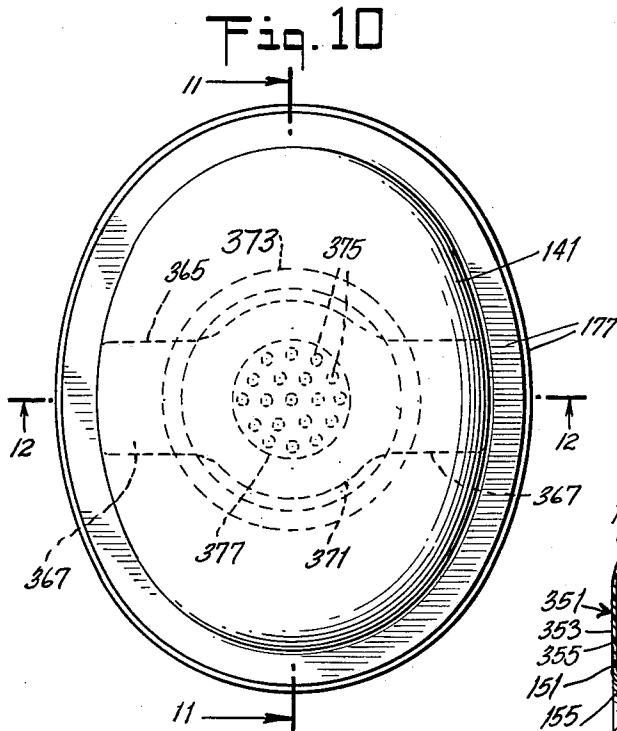
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INVENTOR.  
JACKSON A. AILEO  
BY  
Lester W. Clark  
ATTORNEY

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## RIGID SHELL HELMET AND RIGGING AND SOUND ATTENUATING MEANS THEREFOR

Jackson A. Aileo, Carbondale, Pa., assignor to Leonard P. Frieder, Great Neck, Long Island, N.Y.

Filed May 13, 1960, Ser. No. 29,026

8 Claims. (Cl. 179—156)

This application is a continuation-in-part of my co-pending application Serial No. 792,625, filed February 11, 1959, now U.S. Patent No. 3,005,203, issued October 24, 1961.

This invention relates to a protective helmet and more especially to a helmet providing a rigid outer shell for warding off blows and impact. The invention particularly relates to improved means for supporting the shell upon and in spaced relation to the head of the wearer of the helmet and to means for securing the helmet in place which cooperate with auxiliary devices, including telephonic means supported by the helmet in proper relation to the ear of the wearer.

Until now, in regard to the requirement for telephonic communication between the wearer and another person, the means for supporting the telephonic devices in relation to the ears of the wearer of the helmet have not provided for easy and flexible adjustment consistent with different head sizes and ear positions of the wearer.

It is an object of the invention to provide a helmet having a rigid shell open at the lower side thereof for receiving the head of the wearer and having improved means for supporting telephonic means adjustably with respect to the shell for accommodation to the ears of the wearer.

It is an additional object of the invention to provide improved means for attenuating or excluding external sound which would interfere with the hearing of the telephonic message by the wearer.

It is still another object of the invention to provide means cooperating with the sound attenuating means for controlling the admission and the shunting off of external sounds at will.

The helmet of the invention comprises a rigid shell made of suitable material which may be of known composition, for example one utilizing a plastic binder, which is capable of being molded to shape as a hollow shell open at the lower side thereof for receiving the head of the wearer, the opening being defined by the edge of the shell extending about the head generally horizontally.

In this shell are disposed a plurality of adjustable head straps so that, by adjusting said head straps, the vertical distance from the edge of the opening to the crown of the head may be made greater or less and the lower edge of the helmet shell may be disposed in proper relation to the ears of the wearer. This invention provides for suspending by flexible suspending means sound attenuating means in positions to engage the ears of the wearer. The suspending means is secured to the side wall of the shell, preferably adjacent a bay formed in the edge portion of the shell which extends about the head receiving opening thereof, so that a sound attenuating means which may be in the form of an ear cup of substantial size may be disposed in position to cover the ear of the wearer without engaging the shell. The suspending means, moreover, includes a flexible element, preferably elastic, to provide for stretching and contraction thereof generally in the direction between the shell and the ear cup, this flexible element at its lower end engaging an endless cord extending about a hollow member and over the outer surface thereof, this hollow member providing the main body of the ear cup. The flexible element may be of such form as to loop about the endless cord so as to slip along the length

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of this cord to different positions in relation thereto, so that the hollow member may be rotated in a plane generally parallel to the ear to dispose the hollow member and the telephonic means which it supports in different adjusted positions with respect to the ear. Preferably the hollow member is of generally elliptical form, so that in such rotation the telephonic receiver carried within the hollow member may be brought into the position for optimum conditions of hearing. The detailed construction of the ear cup and the means which supports will be described more particularly in connection with the drawings.

A particular feature of the invention in connection with the sound attenuating means provided by the ear cup and the devices carried thereby, relates to the provision of a valve for effecting and for cutting off through an opening in the wall of the hollow member communication between the exterior and interior of the hollow member. A sound conducting space or passage is provided within the hollow member which communicates with the opening in the wall of the hollow member and with the auditory or sound passage of the ear of the wearer which may be cut off by closing the valve to cut off external sound and noise, communication being established from the exterior to the ear sound passage of the wearer when the valve is opened.

Means also are provided in accordance with the invention for restraining the ear cups against forward movement thereof. This means may include a nape strap connected between the two hollow members serving as ear cups which are disposed at opposite sides of the head and engaging the cords carried by the hollow members at the respective sides. Adjustment of the length of this strap by means of a buckle serves to hold the ear cups in relation to the head against forward movement when the strap extends across the back of the neck.

Further a chin strap may extend between and may be connected as by snap fasteners to a pair of loops respectively engaging the cords of the hollow members at the sides of the head. This chin strap may carry a buckle for adjustment and may be provided with a chin cup for engaging the chin of the wearer.

The cord engaging loops which cooperate with the nape and chin straps ordinarily may be non-elastic since they are readily adjustable by means of the buckles referred to. These straps and the loops cooperating therewith, however, may be made of elastic material if desired.

In accordance with another feature of the invention the telephone instrument is supported within the hollow member by a resilient sound absorbing material, such as foam rubber or plastic, this supporting material being formed to fit to the inner surface of the hollow member and to provide also for the sound conducting passage referred to between the valve openings and the ear of the wearer, this supporting material also providing for entrance therethrough of the leads to the telephone instrument. These leads may be supported outside the hollow member by a loop or loops slidable along the cord of the hollow member.

Means also may be provided which in addition to serving as a nape strap for the purpose above mentioned may comprise a fabric member which engages the cords that extend about the hollow members to provide for the slipping adjustment of the hollow members as described. This fabric member may carry means for attachment of an oxygen mask disposed on the face of and covering the nose and mouth of the wearer and held in place by the fabric member and the nape strap portion thereof engaging the back of the neck.

Other objects and features of the invention will be understood from the description to follow of the drawings in which:

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FIG. 1 shows in perspective a helmet of the invention and the parts supported thereby mounted in position on the head of the wearer;

FIG. 2 shows a front elevation of the helmet;

FIG. 3 is a section on line 3—3 of FIG. 1 showing the ear cup and the means for suspension thereof from the helmet shell;

FIG. 4 is a section on line 4—4 of FIG. 3 showing the valve seat and the openings therethrough;

FIG. 5 is a section on line 5—5 of FIG. 3 showing showing the inner seating surface and the cooperating openings of the rotatable valve elements;

FIG. 6 shows the cord and loop structure of the suspension means of FIG. 3;

FIG. 7 shows in side elevation a helmet utilizing a modification of the ear cup suspension means;

FIG. 8 is a rear elevation of the helmet of FIG. 7, part of the helmet shell being broken away;

FIG. 9 shows a section of line 9—9 of FIG. 7;

FIG. 10 shows the exterior view of a modification of the ear cup of the invention;

FIG. 11 is a section on line 11—11 of FIG. 10;

FIG. 12 is a section on line 12—12 of FIG. 10.

In FIG. 1 is shown a helmet 20 having a rigid shell 21 of suitable material and having an opening at the lower side thereof for receiving the head of the wearer and defined by edge 23 disposed at a level somewhat above the eyes and the nape of the neck.

The shell supports a pair of ear cups 29, as shown in FIGS. 1 and 2, suspended by means secured thereto and secured to the shell by screws 31. The edge 23 of the shell extends about a bay 33 formed in the shell to accommodate the ear cups 29. As described hereinafter, the ear cups 29 are angularly adjustable with respect to the suspension means generally in planes parallel to the ears so as to fit suitably to the ears of the wearer. A strap 35 connects the two ear cups and extends across the nape of the neck. Connecting also to the two ear cups 29 is a chin strap 37 carrying a chin cup 39 engaging the chin of the wearer. The chin strap is omitted in FIG. 2 but loops 41 are shown in FIGS. 1 and 2 for removably connecting the chin strap thereto.

In FIG. 3 is shown in vertical section an ear cup of novel design according to the invention. This ear cup comprises a rigid shell 141 which is of generally elliptical shape in the plane thereof which is parallel to the ear as shown in FIG. 1. The contour of a section of the shell 141 in the plane perpendicular to the ear is that of a hollow member providing a wall 143 extending about a space within the member. The wall 143 extends to and defines the continuous periphery of an opening 145 at the side of the hollow space disposed toward the ear of the wearer. Fitted into the periphery of the hollow member 141 is a ring 147 having a flange 149 of elliptical shape fitting against the inner surface of the wall 143. The ring 147 also has a flange 151 which bears upon the edge surface of the wall 143. This flange has an outwardly extending portion 153 and an inwardly extending portion 155.

Adhesively secured to the face of the flange 151 in the embodiment of FIG. 3 is a padding means 157 of annular form having an exterior contour adapted to engage the ear of the wearer. The padding means 157 may be made of an elastically compressible material, such as sponge rubber, and may be formed as shown to extend over the edge of the outwardly extending portion 153 of the flange 151 into engagement with the outer surface of the wall 143 so as to cover the flange. This padding means 157 also may be adhesively bonded to the back surface of the padding means 145. The form of the wall 143. For comfort a cover layer 159, for example of soft leather, may be adhesively secured to the outer surface of the padding means 147. The form of the annular padding means 157 is such that an opening 161 is provided which is generally concentric with the open-

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ing 145 of the rigid shell 141 and of adequate area to provide free communication with the sound passage of the ear and with the space within the hollow member 141, the contour of the surface of the padding means and its cover 159 being such as to close off communication with the exterior air when the ear cup is pressed against the ear.

The ear cup of the invention is supported from the shell 21 of the helmet by means of flexible elements 163 in the form of fabric loops supported on the shell by means of screws 31 passing through holes in the shell and threaded in nuts 167 the hubs of which are disposed in holes 169 in the fabric loops. The ends of the nuts 167 are held securely against the inner surface of the shell 21, the flange 171 of the nut being disposed outwardly of but adjacent the portion of the loop 163 which is adjacent the inner surface of the shell. The loops 163 thus are supported for pivotal movement on the nuts 167 as well as for flexing movement transverse to the shell wall without engagement of the cup with the shell.

The loops 163 are looped about a cord 173 which in this embodiment is provided with two wraps about the hollow member 141 in fairly tight relation to the outer surface thereof. The cords 173 may be relatively inextensible or may have a certain degree of elasticity lengthwise thereof, if desired. Either by virtue of elasticity or of the tightness of adjustment which may be accomplished by tying the ends of the cord as shown at 175 in FIG. 6, the loops 163 may be held in sliding relation to the outer surface of the hollow member 141 but with a certain amount of frictional engagement therewith, so that the loops may be moved along the cords to a desired position or, conversely, the cord may be moved relative to the loop. In any position to which it is moved the loop will be held in substantially fixed relation to the hollow member 141.

As shown in FIG. 3 the hollow shell 141 is formed with spaced upstanding flanges 177 extending about the elliptical periphery of the shell at either side of the cord 173. These flanges 177 serve as guides for the loop 163 and also to restrain the cords 173 from lateral movement relative to the shell 141. Thus, the ear cup is suspended from the shell 21 in such position relative to the ears as to be moved into engagement with the ear by virtue of the flexibility of the loops 163. Further, as will be understood from a consideration of FIGS. 1 and 6, the ear cups may be moved rotationally in a plane parallel to the ears relative to the loops 163 to bring the padding means 157 into comfortable relation to the ear and to the wearer's head about the ear so as to fit well thereto in order to exclude external sound. Preferably, also the loops 163 are made of elastic material so as to provide a certain amount of stretch between the screws 165 and the cords 173 in order to provide for a certain amount of generally vertical movement of the ear cup relative to the shell for adjustment to the ear. Moreover, the flexible suspension, having regard to the provision of the bays 33, insures the proper disposition of the ear cup without sound transmitting contact thereof with the shell 21.

In order to hold the ear cup in the adjusted position thereof with respect to the ear, the chin strap 37 above mentioned may be adjusted by adjusting the end portion 181 engaging a buckle 183 connected to a fabric element 185 which carries a snap fastener 187 engageable with the cooperating fastener 189, FIGS. 2 and 6, secured to the loop 41 above mentioned. The loop 41 engages the cord 173 in the manner described for the loops 163, so that this loop may be moved along the cords while being held in frictional relation thereto, or the ear cup may be rotated as described with corresponding relative movement of the cord 173 and the loop 41. At the opposite side of the head from that shown in FIG. 1, a similar cord engaging loop 41 is disposed, FIG. 2, carrying snap fastener 189, a cooperating fastener 187, not shown, being provided at this end of the strap 37.

By adjusting the buckle 183 a certain amount of pull may be brought upon the ear cup against the bias of the

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loops 163. This tension serves to hold the ear cups in the desired position in the generally vertical direction as well as to draw the ear cups toward the ear. The disposition of the flanges 177 providing the channel in which the cords 173 are disposed, moreover, is such that, having regard to the spacing of the helmet shell 21 from the head, the surface of the padding means 157 and its leather cover 159 will be pressed against the ear of the wearer and against adjacent portions of the wearer's head.

The strap 35 which extends across the nape of the neck, as above mentioned, also is provided similarly with a buckle 191 through which the end 193 of the strap 35 is passed for adjustment, this buckle also being carried by a loop 195 which engages the cord 173 in the same manner as the loop 41 for sliding movement relative to the cord. The opposite end of the strap 35 may be directly looped about the cord 173 of the ear cup at this opposite side of the head. It will be understood that the pull of the straps 35 and 37 may have a resultant directed generally downward in FIG. 1 against the elastic bias of the loops 163, so that the ear cups are held by these opposed tensions in the desired relation to the ears.

In order to provide for support of the telephonic instrument or ear phone, within the hollow space of the rigid shell 141 and filling a considerable portion of this space, in accordance with this invention, a body 201, FIG. 3, of sound absorbing material such as sponge rubber is disposed. The body is formed with an external contour fitting to the inner surface of the hollow member 141 and fills the major portion of the space within this hollow member. The sound absorbing body 201 has a generally centrally disposed pocket 203 formed therein for receiving the telephone instrument. In order to retain this instrument in this pocket, a layer 205 of similar sound absorbing material is adhesively secured to the body 201, the layer 205 having an opening 207 somewhat smaller than the opening of the pocket 203, so that the edge of the layer 205 about the opening 207 may bear upon the telephone instrument to retain it in the pocket and supported by the body 201. A suitable restricted opening, not shown in the drawing, may be provided through the body 201 and through the hollow member 141 for electrical leads connected to the telephone instrument. It will be understood, because of the elastic character of the sound absorbing body and of the retaining layer 205, that the telephone instrument may be inserted in place by elastic deformation of the layer 205 adjacent the opening 207, the leads having been attached to the instrument before inserting it through the opening 161 and through the opening 207 into the pocket.

It is a particular feature of the invention that the ear cup as shown in FIG. 3 is provided with means operable at will for establishing and disestablishing communication between the auditory passage of the ear of the wearer and the exterior atmosphere. To this end a boss 209 is formed on the wall of the hollow member 141 and is provided with a flat valve seat 211. Openings 213, three as shown in FIG. 4 in this embodiment, are provided in the boss 209 leading into the interior space of the hollow member 141. A portion of the sound absorbing body 201 is cut away adjacent the openings 213 to provide a space 215 communicating freely with the opening 161 and there-through with the auditory passage of the ear. The space 215 includes a portion 217 which extends generally horizontally, as in FIG. 3, beneath the pocket 203 in which the telephone instrument is supported by the sound absorbing body 201 but separated from the pocket by a portion of the sound absorbing body.

On a stud 219 extending through a hole 221 in the boss 209 and threaded in a nut 223 is rotatably supported a valve 225 having a flat surface 227 engaging the valve seat 211. The valve 225 is provided with openings 229, three as shown in FIG. 5, which upon rotation of the valve 225 are brought into register with the openings 213 through the hub 209, thereby to establish communica-

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tion from the exterior of the ear cup through the openings 213 and the spaces 215, 217 and through the opening 161 to the auditory passage of the ear. Upon rotation of the valve 225 to the position shown in FIG. 3 such communication is cut off and extraneous sounds which otherwise would reach the ear are cut off so that the sounds of the telephonic instrument may reach the ear without interference by such extraneous sound and noise. When it is desired, however, to listen to sound or speech reaching the wearer directly through the air, the valve 225 may be rotated to open position.

For securing a fairly tight fit the better to cut off communication through the air, the valve 225 may be formed, as shown in FIG. 3, with a flange ring 231 which extends about and engages the outer surface of the boss 209. In the peripheral extent of this flange ring a space 233 may be provided for receiving a lug 235 which serves as a stop for the rotational movement of the valve as the ends of the flange 231 are brought into engagement with the lug, as shown in FIG. 4, carried by boss 209.

The shell 21 of the helmet may be generally of conventional form while providing the bay 33 and may be made of suitable material such as a molded plastic in accordance with conventional methods. The head straps located inside of said helmet may be provided by closely woven strong tapes ordinarily without substantial stretch lengthwise thereof. If desired, however, these head straps may be made of elastic tapes of conventional fabric construction, or may be provided with elastic sections, such that a certain degree of stretch and of tension will be developed therein as the chin strap and nape strap are drawn concomitantly with elastic stretch of the loops 163 as above described. The chin strap 37 and nape strap 35 also may be made of elastic material if desired but preferably are of strong tapes without substantial elastic extensibility in order that, when the buckles are adjusted, the parts supported by these straps will remain adjusted to the head and chin of the wearer of the helmet. Quick connection or disconnection, therefore, may be effected by snapping or unsnapping the snap fasteners 187 with respect to the corresponding fastener 189 with assurance that the parts will remain in position for fitting the head, ears and chin of the wearer.

The rigid shell 141 of hollow form also may be made of a suitable plastic molded to shape but if desired this hollow member may be made of other materials which are suitable for the purpose of holding the sound absorbing body 201 and the other parts within the shell 141 and capable of supporting the valve 225 as described. The valve also may be made of plastic molded to form to fit to the boss 209 of the hollow member 141.

The helmet shown in FIGS. 7 and 8 embodies certain modifications of the suspension means for the ear cups.

In FIGS. 7 and 8 the helmet 20 comprises a shell 21 open at the lower side thereof and having the edge 23 of the shell opening formed with a bay 33, as in the embodiments of FIG. 1. In this modified form, instead of the loops 163 which engage the cords 173 as in FIGS. 1, 3 and 6, the helmet is provided with a fabric member 251 having an upper portion 253 which is cut with the contour of its edge 255 generally parallel to the outline of the edge of the bay 33 of the shell 21. This upper portion 253 is secured to the inner surface of the shell 21 and threaded in nuts 167 the hubs of which are disposed in holes 169 in the portion 253 similarly to the screws 31 of FIG. 3. The flanges 171 of the nuts 167 engage the portion 253 of the fabric member and hold it securely against the inner surface of the shell 21.

The fabric member 251 also has a lower depending portion 257 provided with an opening bound with a tape 259 as shown in FIG. 9, this tape extending about the cord 173 disposed in the channel provided between the upstanding flanges 177 carried upon the hollow shell 141 of a near cup having the same general form and con-

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struction as the ear cup shown in FIGS. 1 to 6, inclusive. The cords 173 thus hold the portion 257 of the fabric member in engagement with the outer surface of the hollow shell 141 while also providing for slipping movement of the shell 141 relative to the taped edge of the opening of the fabric member in the same manner as described for the shell 141 with respect to the supporting loops 163 in FIGS. 1 and 13. The shell 141, therefore, may be rotated relative to the fabric member 251 in the plane parallel to the ear between angularly related positions to provide for fitting to the ear of the wearer, as described in connection with the helmet of FIGS. 1 and 2. The fabric member is sufficiently flexible to accommodate this rotation, as described more completely in my U.S. Patent No. 3,005,203, mentioned above.

For purposes of manufacture and in order to provide a fabric member 251 such that its upper portion 253 suitably may conform to the inner surface of the shell 21 and so that its depending portion 257 may conform to the head and face of the wearer, the fabric member 251 may be made in these two separately formed parts, the portion 253 being joined to the depending portion 257 in lapping relation, as shown in FIG. 9, along a seam which extends generally along the upper arcuate extent of the channel provided by the upstanding flanges 177. Having regard to this joining of the two portions 253 and 257, the fabric member 251 as a whole is suspended from the shell by the screws 165, there being such upper and lower portions carrying earcups at the opposite sides of the helmet. In order to provide additional suspending support for the parts of the depending portions 257 which are disposed rearwardly of the earcups 141, straps 263 are stitched to the portions 257 at either side and extend upwardly within the shell 21 where each strap is engaged at its upper end by one of the screws 165 which secures the upper portions 253 of the fabric member to the shell 21 of the helmet.

As shown in FIGS. 7 and 8, the lower portions 257 of the fabric member also are connected, integrally in the embodiment shown, to a nape portion 265 which extends from the lower portion 257 at one side of the head across the back of the head or neck to the corresponding portion 257 at the opposite side of the head. This nape portion 265 also may carry an adjustable nape strap 267 provided with a buckle 269, the ends of the nape strap 267 being stitched as at 271 to the nape portion 265 of the fabric member, so that the length of the connection between the depending side portions 257 of the fabric member 251 may be adjusted to suit the required distance from the earcups across the back portion of the neck or head of the wearer. The edges of the depending portions 257, of the upper portions 253 and of the nape portion 265 may be bound with tapes 261, 273 and 275, as shown in FIGS. 7 and 8, to prevent fraying. It will be apparent that the earcups 141 at either side of the head may be suspended in proper relation to the head of the wearer of the helmet and for adjustment with respect to the ears in the same general manner as described in connection with the embodiments of FIGS. 1 and 2.

In the embodiment of FIGS. 7 and 8 each lower portion 257 of the fabric member may carry a reinforcing element 277, as shown in FIG. 7, which may be stitched along its edges to the fabric portion 257, this element 277 carrying one of the two cooperating elements 279 of a conventional snap fastener the other element of which may be carried by the strap or other suitable part of a chin strip or of a gas mask, not shown in the drawing. In the embodiment of FIG. 7 the elements 279 shown are suitable for connecting a gas mask or other such device in proper fitting relation to the face of the wearer. The snap fastener elements 279 may be secured to the reinforcing elements 277 in any conventional manner, preferably so that they are fastened both to the portion 257 of the fabric member 251 and to the reinforcing element 277. This reinforcing element 277 may be made of

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sheet leather or of other material suitable for the purpose. It will be understood that the forward pull of straps or other parts exerted upon the snap fastener elements 279 may be carried through the depending portion 257 of the fabric member 251 and may be resisted by the nape portion 265 in engagement with the back of the neck or head. Such pull in some cases may have a component acting generally vertically and the straps 263 may cooperate with the nape portion 265 and its auxiliary strap 267 to resist such pull exerted on the rearward part of the lower portion 257 of the fabric 251, so as to retain this portion suitably conforming to the face of the wearer of the helmet.

It will be understood that the construction of the hollow shells 141 and the several means supported thereby may be the same in the embodiment of FIGS. 7 and 8 as is shown and described in connection with FIGS. 1 to 6, inclusive. Also the loops 41 carried by the respective earcups 29 in the embodiment of FIGS. 1 and 2 which, as disclosed in connection with those figures, serve to support the chin cup 39 may be utilized with modification if necessary as to form, extent of engagement with the cords 173 or other change in dimensions or materials, so that the loops 41 may serve for attachment of a gas mask or the like similarly to the part of the portion 257 of the fabric member 251 in the embodiments of FIGS. 7 and 8 which carries the reinforcing leather, if necessary a plurality of snap fasteners 189 being provided on the loops 41, FIG. 2.

The modified ear cup shown in FIGS. 10, 11 and 12 is generally the same as that shown in FIGS. 1 and 3. The reference numerals relating to like parts are the same in FIGS. 10, 11 and 12 as in FIGS. 1 and 3. This modified ear cup is in the form of a hollow rigid member or shell 141 of elliptical shape provided by wall 143 extending about the space within the hollow rigid member. Engaging the periphery of the hollow member 141 is a ring 147 having a flange 149 of elliptical shape fitting against the inner surface of the wall 143 the same as in FIG. 3. The ring 147 also has a flange 151 transverse to flange 149. This flange 151 has an outwardly extending portion 153 which bears upon the edge of the wall 143 and an inwardly extending portion 155. The ring 147 may be secured in the hollow member 141 by cementing the flange 149 to the wall 143 with a suitable cement.

A padding means for engagement with the ear of the wearer and to close off communication of the inner space of the ear cup with the exterior air in this embodiment is provided by an elliptical annular member 351 which may be formed of a plastic and having spaced walls 353, 355 defining a hollow space within said elliptical member, these walls being sealed together at the inner periphery 357 of the elliptical member 351. The walls of the member 351 may be molded so as to be continuous about a ring 359, which may be of a plastic or other suitable material, of such cross section and of such diameter of its annulus as to bring the portions of the walls 353, 355 that extend about the ring 359 into close engagement with the outwardly extending portion 153 of the flange 151 and with the exterior surface of the wall 143, as shown in FIG. 11. The ring 359, if desired, may be somewhat elastic to hold the member 351 in such engagement with the wall 143. The member 351 thus may be removed and put in place by slightly stretching the ring 359. A certain amount of air may be sealed within the inner space of elliptical member 351 to secure the desirable soft cushion for engagement of the surface of the member 351 comfortably with the ear. The opening defined by the inner periphery 357 of the elliptical member 351 communicates with the space within the hollow member 141. This hollow member also is provided with outwardly extending flanges 177 defining between them the channel in which the cords 173 of the suspension means described in connection with FIGS. 1 to 6 may be disposed.

The ear cup of this embodiment also may carry a lin-



ing 361 of sound absorbing material, such as sponge rubber, to limit the transmission of noise and extraneous sound from the exterior through the wall into the space within the hollow member 141.

For support of a telephone instrument 363 the ear cup of the embodiment of FIGS. 10, 11 and 12 utilizes a bridge piece 365 which is adapted to span across the ear cup with the ends 367 engaging the inner peripheral surface of the inwardly extending flange 149 and the inner surface of the flange portion 155 when the bridge piece is in the position shown in FIGS. 10 and 12 disposed on the shorter axis of the ellipse of the ear cup. By turning the bridge piece 365 to a position at a right angle to position of FIG. 10, this bridge piece may be removed from the cup because its length is more nearly equal to or may be shorter than the dimension from the point on the inner annular periphery 357 of the member 351, or the inner periphery of flange 151, and a point adjacent the back wall of the hollow member 141 in the vertical plane in FIG. 10. Thus, in this new position the bridge piece may be removed from the hollow member 141 by tipping it in the vertical plane. Preferably the bridge piece 365, however, is made of a material having a certain resilience which will provide for sufficient spring of the bridge piece to bring the ends closer together and thereby more easily to provide for its removal. It will be understood also that the bridge piece may be put into place by inserting one end of it as it is disposed along the long diameter of the ellipse, that is, along the vertical in FIG. 10, and then disposing or springing the other end beneath the flange 151. Thereafter, upon rotating the bridge piece to a position at right angles from the vertical with the ends thereof engaging the inwardly projecting flange 149, the bridge piece is held in place in the dotted position of FIG. 10 by virtue of its resilience.

In some cases, however, a bridge piece of rigid form may be used, it being properly dimensioned to provide for insertion in the manner described having regard to the long and short dimensions of the ellipses at the inner annular periphery 357 and at the inner surface of the flange 149. Since ordinarily the sound insulating material 361 such as sponge rubber also is resilient, this material may be compressed wherever the end of the bridge piece is brought into engagement therewith so as to gain clearance.

As shown more particularly in FIGS. 11 and 12 the bridge piece 365 is of generally U shape having in this embodiment the ends 367 extending in angular relation to leg portions 369, these leg portions being connected to a flat base part 371 which extends transversely of the center line of the ear cup and is inwardly disposed with respect to the flange 155, FIG. 12. As shown in the drawings, the base portion 371 may be disposed for engagement with the forward face of a cover 373 of the telephone instrument 363. As shown in FIG. 10, this cover may be provided with perforations 375 for transmission therethrough to the ear of the sound produced by the instrument. In order to avoid interference with such transmission the bridge piece 365 in the flat base part thereof is provided with a circular opening 377, this base part 371 having an outer partially circular contour of larger diameter than the opening 377, the legs 367 of the U being connected to this base part 371.

When it is desired that the bridge piece be resilient it may be made of a resilient material such as a metal or preferably a plastic which is semi-rigid but has a certain springiness to provide for slight bending thereof to aid in the insertion and removal of the bridge piece to and from the position shown in the drawings. Such a bridge piece may be made of a sheet material cut by a die or similar means to the form shown and to provide the opening 377, or the bridge piece may be produced by molding especially when made of plastic.

It will be noted in the embodiment being described that the bridge piece 365 holds the telephone instrument 363 against the sound absorbing lining 361 and with a certain amount of compression of portions of this lining, the contour of the lining which as first inserted in the hollow shell 141 may have a more or less uniform thickness being altered as typically shown in FIGS. 11 and 12. Thus the telephone instrument 365 becomes biased toward the rear face of the base part 371 of the bridge piece 365, so that this instrument is held in the position shown and in sound transmitting communication with the space within the ear cup and with the ear of the wearer.

It will be understood that the electric leads for the telephone instrument may be brought into the space within the hollow member 141 by suitable openings, not shown, in the wall thereof. When desired also the space between the walls 353 and 355 of the annular elliptical ear engaging member 351 may be wholly or partially filled with a liquid which may be sealed within the space by sealing the member along the inner periphery 357 or by other means and method. Having regard to the resilient nature of the sound absorbing material 361, this material may be inserted in the shell 141 through the opening of the flange 151, this material 361 being held in place thereafter by the edges thereof being in abutting engagement with the inner face of the flange 151.

In the several embodiments of the invention described and in the different parts shown and described by way of illustration of operative devices embodying the features of the invention, variations may be made both in the form of the different parts and in the materials of which they are made while securing the functions as described, or equivalent functions, which carry out the features of the invention. The invention is not limited, therefore, to the particular embodiments disclosed and all such variations are intended to come within the scope of the appended claims.

I claim:

1. A sound attenuating device for a head covering having a rigid shell adapted to receive the head of a wearer which comprises a hollow member providing a wall extending about a space within said member and defining the continuous periphery of a substantially elliptical opening at one side of said space, means carried by said member adjacent and extending along said periphery of said opening and adapted to engage the head of the wearer about his ear so as substantially to close off communication of the sound passage of the ear with the atmosphere, said hollow member being provided with a channel open at the exterior surface of said hollow member and disposed generally in a plane parallel to the plane of said opening of said hollow member, an element of flexible material having a fold inserted in said channel and two generally parallel portions extending outwardly of the channel from the fold, said parallel portions being fastened together outside the channel and cooperating with the fold to form a loop, means connecting said fastened parallel portions of the loop element to the shell, an elongated tightenable member disposed in said channel and extending throughout the length of the channel and through said loop, said tightenable member being tight enough to hold said loop in frictional engagement with the hollow member, while permitting sliding movement of the loop along the channel relative to the hollow member to dispose said hollow member in different positions relative to said shell.

2. A sound attenuating device for a head covering having a shell adapted to receive the head of a wearer, said sound attenuating device comprising a hollow member having a wall extending about a space within the member and defining the continuous periphery of an opening having a generally elliptical shape at one side of said space, means carried by said hollow member and adapted to be

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attached to said shell to support said hollow member adjacent to the ear of the wearer of said head covering, means including an inwardly extending flange member carried by said hollow member adjacent and extending along said periphery of said opening and adapted to engage the ear of the wearer of the head covering to substantially close off communication of the sound passage of the ear with the atmosphere, a diametrical bridge piece extending between opposite sides of said hollow member and behind the edges of said flange member at the minor axis of the elliptical shape of said opening, said bridge piece being adapted to engage a telephone instrument disposed within said hollow member for holding said instrument within said hollow member, the ends of said bridge piece being spaced at a dimension less than the spacing between the inner edges of said flange member at the major diameter of the ellipse of said opening to provide for insertion and removal of said bridge piece concomitantly with turning movement thereof between the spanning position thereof and a position in angular relation thereto.

3. A sound attenuating device comprising an ear cup having a generally elliptical rim and adapted to receive the ear of a wearer, cushion means on the rim adapted to engage the head of the wearer about his ear so as substantially to close off communication of the sound passage of the ear with the atmosphere, said ear cup having a peripheral channel open only at the exterior surface of the ear cup and disposed generally in a plane parallel to the open end of the ear cup, an element of flexible material having a fold inserted in said channel and two generally parallel portions extending outwardly of the channel from the fold, said parallel portions being fastened together outside the channel and cooperating with the fold to form a loop, supporting means connected to said fastened parallel portions of the loop element, an elongated tightenable member disposed in said channel and extending throughout the length of the channel and through said loop, said tightenable member and said channel cooperating to permit sliding movement of the loop along the channel to dispose the ear cup in different angular positions relative to the loop and to the supporting means, and to hold the ear cup frictionally in any of said angular positions.

4. Head covering and sound attenuating apparatus, comprising:

- (a) a rigid shell adapted to receive the head of a wearer and having a lower edge recessed at either side to define bays above the ears of the wearer;
- (b) two ear cups, each adapted to receive an ear of the wearer and having:
  - (1) a generally elliptical rim;
  - (2) cushion means on the rim adapted to engage the head of the wearer about his ear so as to close off communication of the sound passage of the ear with the atmosphere; and
  - (3) a peripheral channel open only at the exterior surface of the ear cup and disposed generally in a plane parallel to the open end of the ear cup;
- (c) means for supporting each ear cup from the shell, comprising:
  - (1) two elements of flexible material, each having a fold inserted in the channel of its associated ear cup and two generally parallel portions extending outwardly of the channel from the fold, said parallel portions being fastened together outside the channel and cooperating with the fold to form a loop;
  - (2) an elongated tightenable member disposed in the channel and extending throughout the length of the channel and through the loops of the supporting elements, said tightenable member and said channel cooperating to permit sliding movement of the loops along the channel to

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dispose the ear cup in different angular positions relative to the loops and to hold the ear cup frictionally in any of said angular positions; and

- (3) means connecting the fastened parallel portions of the supporting elements to the shell at localities adjacent the bay and spaced longitudinally of the shell.

5. Head covering and sound attenuating apparatus as defined in claim 4, including:

- (a) chin strap means adapted to engage the chin of the wearer and including:

- (1) at each end, a third element of flexible material looped between the tightenable member and the channel of the adjacent ear cup; and
- (2) means for adjusting the length of the chin strap means;

- (b) nape strap means adapted to engage the nape of the wearer's neck and including:

- (1) at each end, a fourth element of flexible material looped between the tightenable member and the channel of the adjacent ear cup; and
- (2) means for adjusting the length of the nape strap means;

- (c) said nape strap means and said chin strap means being flexible and substantially inelastic, so that, once adjusted, they remain in position on the wearer's head and nape;

- (d) said two elements of flexible material for each ear cup being yieldable to accommodate different length adjustments of the chin strap means and nape strap means and different angular positions of the ear cups with respect to said loops.

6. A sound attenuating device comprising:

- (a) an ear cup adapted to receive the ear of a wearer;
- (b) cushion means on the rim of the cup adapted to engage the head of the wearer about his ear so as substantially to close off communication of the sound passage of the ear with the atmosphere;
- (c) a body of sound absorbing material inside the ear cup and confined by the ear cup for absorbing extraneous sound transmitted into the cup;
- (d) valve means mounted on the ear cup at one side of the outer end thereof, and manually operable from the outside thereof between open and closed positions;

- (e) said body of sound absorbing material defining a passage along said one side of the ear cup and communicating with said valve means at one end and adapted to communicate with the sound passage of the wearer's ear at the other end;

- (f) said body of sound absorbing material further defining a central pocket adapted to receive a telephone transducer and also adapted to communicate with the sound passage of the wearer's ear.

7. A sound attenuating device as defined in claim 6, including stop means for limiting manual movement of the valve means at said open and closed positions.

8. A sound attenuating device as defined in claim 6; in which said valve means comprises:

- (a) a cylindrical boss extending outwardly and downwardly from said ear cup and terminating at its outer end in a plane surface, said boss having at least one aperture extending lengthwise thereof and communicating with said passage;
- (b) a valve disc rotatably mounted on the outer end of the boss and having an aperture therein aligned with the boss aperture when the valve means is open and out of alignment with the boss aperture when the valve means is closed; and
- (c) a cylindrical flange on said valve disc overlying the end of the cylindrical surface of the boss.

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ROBERT H. ROSE, *Primary Examiner.*

THOMAS J. HICKEY, THOMAS B. HABECKER,  
*Examiners.*

**UNITED STATES PATENT OFFICE**  
**CERTIFICATE OF CORRECTION**

Patent No. 3,190,973

June 22, 1965

Jackson A. Aileo

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

Column 1, line 40, for "shunting" read -- shutting --;  
column 2, line 10, for "is" read -- it --; column 3, line 11,  
strike out "showing"; lines 70 and 71, strike out "of the padding  
means 145. The form of the wall 143.", and insert instead -- of  
the outwardly extending flange 153 and to the wall 143. --;  
same column 3, line 73, for "147" read -- 157 --.

Signed and sealed this 28th day of December 1965.

**(SEAL)**

**Attest:**

**ERNEST W. SWIDER**

**Attesting Officer**

**EDWARD J. BRENNER**

**Commissioner of Patents**