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DE-ICER BOOT FOR BREATHING MASK

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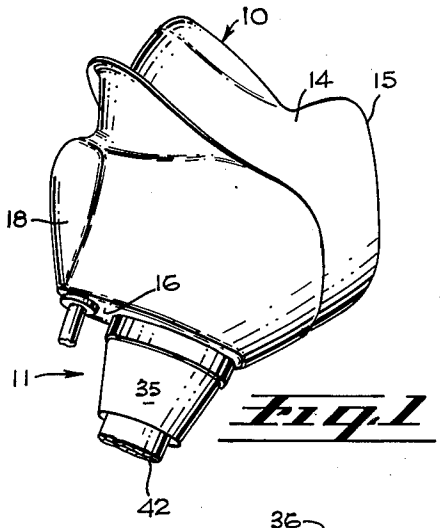

Fig. 1

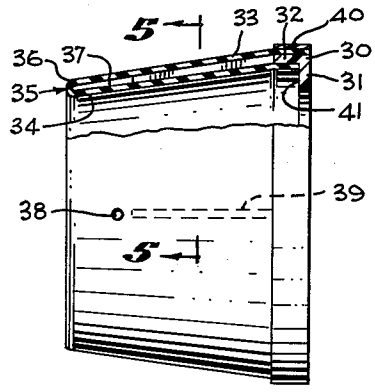

Fig. 4

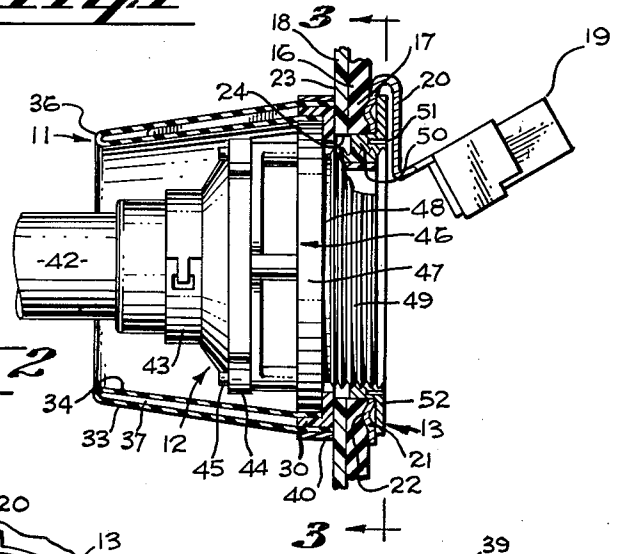

Fig. 2

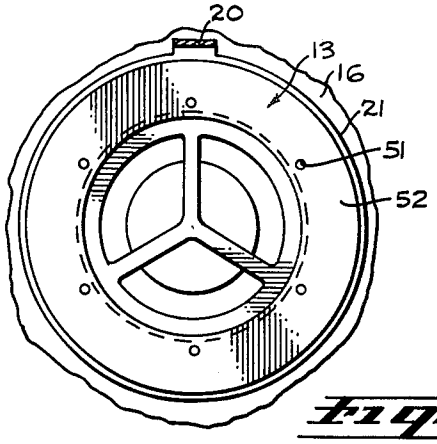

Fig. 3

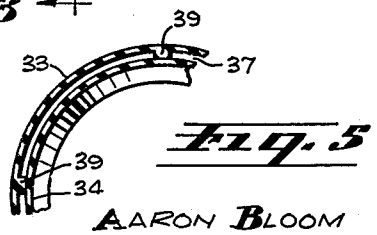

Fig. 5

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DE-ICER BOOT FOR BREATHING MASK

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The invention relates to respiratory apparatus and more particularly to a breathing mask of the type used by aircraft pilots for high altitude flying. More particularly the invention relates to an attachment or accessory for a high altitude breathing mask which surrounds the combined inhalation-exhalation valve housing immediately outside of the oro-nasal receptacle and is of such character as to inhibit to a substantial degree accumulation of frozen moisture derived from the gases exhaled by the pilot during use of breathing apparatus at high altitudes.

It has been recognized that when oxygen or breathing masks are used by aircraft flight personnel under conditions of high altitude flying, the oxygen or air supply directed into the mask passes oxygen or air for breathing at temperatures far below freezing. The temperatures actually experienced in fact are as low as 60 degrees below zero Fahrenheit and in some instances lower. As masks of this type are ordinarily constructed, the valving consists of a valve housing in which is incorporated two valves in combination, namely, an inflow check valve and an exhalation valve, one surrounding the other in the interest of maintaining compactness in the equipment. Since the gases exhaled from the lungs of the operator contain considerable moisture, the moisture tends to condense within the valve housing upon being expelled therefrom and under circumstances where the oxygen being supplied, for example, may be as low as 60 degrees below zero Fahrenheit, the extremely cold condition tends to chill the valve housing and component parts to such an extent that the moisture is frozen in and around the exhalation valving. On some occasions there is enough caking of frozen moisture to seriously impair the proper functioning of the mask or even to render the mask almost unusuable unless the moisture can be broken away or the mask, in a sense, de-iced.

In recognition of this necessity masks have been constructed with a de-icer boot integrally formed with the oro-nasal receptacle and the combined boot and receptacle then covered by the customary hard-shell modified to the extent that the hard shell also surrounds the de-icer boot. Although the presence of a de-icer boot in this form is of appreciable help in inhibiting the accumulation of ice around the combined inhalation-exhalation valve housing, the construction is such that the icing can be broken away only with considerable difficulty. In other words, it requires considerable effort for the operator with his gloved hand to distort the hard-shell sufficiently to fold and wrinkle the de-icer boot contained therein enough to break loose the ice.

Other disadvantages also exist in devices heretofore available in that the process of moulding a composite receptacle and de-icer boot together makes for a difficult moulding operation, expensive moulds, and time-consuming operations in stripping the mould, cleaning the composite moulded article, and thereafter attaching to it the necessary accessories, such, for example, as the valve housing. Even the step necessary for positioning and

anchoring the resilient oro-nasal receptacle within the hard-shell has its detrimental features in that it is time-consuming, especially in arranging the hard-shell and the receptacle in a strictly proper relationship with respect to each other as a sub-assembly.

It is therefore among the objects of the invention to provide a new and improved de-icer boot for breathing masks which is constructed as a sub-assembly for attachment to the remaining mask assembly, thereby to greatly simplify the problems both of construction and assembly.

Another object of the invention is to provide a new and improved combined breathing mask and de-icer boot which are initially constructed as separate sub-assemblies and thereafter joined together in operating relationship by virtue of providing connecting parts, all of which can be attached together by a single connecting means.

Still another object of the invention is to provide a new and improved combined breathing mask and de-icer boot wherein the inhalation-exhalation valve housing is so constructed that it serves as part of the means for interconnecting the de-icer boot with the mask sub-assembly, thereby to connect all of the parts by use of a single screw-threaded connection which extends through the passages normally considered as the supply passages to the oro-nasal receptacle.

Still further included among the objects of the invention is to provide a simple, separate de-icer boot capable of being assembled as a sub-assembly entirely separate and apart from the valve housing and the oro-nasal receptacle whether used with or without a surrounding hard-shell, the de-icer boot being such that after insertion of the valve housing within it, these parts can be quickly and easily attached together to the mask assembly by a connecting ring which serves not only to seal the connection between the several parts but which may also serve as a means of attaching the mounting bracket of a microphone contained within the mask assembly.

Also included among the objects of the invention is to provide a new and improved mask assembly wherein a combined mask and hard shell are formed to present a rigid platform at the lower forward portion upon which the valving sub-assembly can be mounted and subsequently removed therefrom when needed, the valve sub-assembly being so designed that it can include a separately moulded de-icing boot removably secured therearound.

With these and other objects in view, the invention consists in the construction, arrangement and combination of the various parts of the device, whereby the objects comtemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a side perspective view of the combined breathing mask and de-icer boot in assembled condition.

FIGURE 2 is a longitudinal sectional view of the assembled portions of the device with the mask assembly broken away.

FIGURE 3 is a cross-sectional view taken on the line 3—3 of FIGURE 2.

FIGURE 4 is a side elevational view of the de-icer boot sub-assembly partially broken away to show the interior construction.

FIGURE 5 is a fragmentary cross-sectional view taken on the line 5—5 of FIGURE 4.

In an embodiment of the invention chosen for the

purpose of illustration a combined breathing mask and de-icer boot is shown particularly in FIGURE 1 consisting of a mask assembly indicated generally by the reference character **10** and a de-icer boot assembly indicated generally by the reference character **11** joined together with the assistance of portions of a combined inhalation-exhalation valve housing **12**, as shown in FIGURE 2. The connection is made by employment of a fastening sleeve indicated generally by the reference character **13** which threadedly engages the valve housing and holds all of the parts together in the manner illustrated in FIGURE 2.

The mask assembly **10** is built in conformance with accepted standards and consists of an oro-nasal face receptacle **14** which normally fits over the chin, mouth and nose of the user and is constructed, usually of relatively thin, flexible, resilient rubber or synthetic plastic material of comparable consistency. The receptacle is provided with a face-contacting sealing gasket **15** around the open end which fits the contour of the face of a user in accordance with well-known design. In the present embodiment the receptacle extends forward and terminates in what may be termed a hose attachment area **16**, the inner portion of which may best be described as an annular mounting gasket **17**. The gasket **17** provides a supply passage therethrough for the oro-nasal face receptacle.

Surrounding the forward portion of the receptacle is a hard-shell **18** constructed of a semi-rigid fiber-like hard board moulded to conform to the shape of the forward portion of the receptacle and distended outwardly to a degree in order not to compress any portion of the flexible receptacle inwardly. It will be understood that the receptacle has a chamber inside (not shown) which is large enough to permit free movement of the jaws and lips of the user so that he can talk readily and easily in order that his voice may be effectively picked up by a microphone **19** within the receptacle mounted upon a bracket **20** having a part thereof shaped like a washer **21** provided with a bead **22** to improve the ease of sealing when the parts are assembled in the manner shown in FIGURE 2.

The hard-shell **18** has a relatively flat outer area **23** in which is a passage **24** which coincides with the passage formed by the mounting gasket **17** and which also serves as a supply passage.

The de-icer boot assembly identified in FIGURE 1 and shown in greater detail in FIGURES 2 and 4 consists of an annular mounting ring **30**, preferably made of some hard synthetic plastic material, the ring being provided with an annular, relatively flat, transverse flange **31** and an annular axially extending flange **32** at its outer perimeter. The mounting ring serves as a means for interconnecting inside ends of an exterior wall **33** and an interior wall **34** in the form of a double walled sleeve **35**. The outside ends of the walls **33** and **34** are joined together by a fold **36** so as to enclose an insulating space **37**. Actually the exterior and interior walls comprise one continuous piece of flexible resilient sheet material of rubber-like consistency substantially the same as the material of the receptacle **14**, although perhaps of slightly thinner gauge. A vent hole **38** is provided in order to equalize pressure outside and inside the sleeve so that it will not either balloon out or collapse with changing pressures. Ribs **39** are also provided between the walls so as to assure that they remain spaced from each other at all times, thereby to preserve the presence of the space **37**.

The inside end of the exterior wall **33** overlies the axially extending flange **32** and is firmly held in position upon the flange by an annular band **40**. The inside end of the interior wall **34** lies in engagement with the inside surface of the axially extending flange **32** and abuts against a face **41** of the transverse flange **31**.

The valve housing **12** previously identified is adapted to have connected thereto a supply hose **42** of conventional construction by use of an appropriate clamp **43**. A body **44** of the valve housing is attached by means of screws **45** to a connecting ring **46**. The connecting ring has a cylindrical exterior **47** which presses lightly against the inside end of the interior wall **34**, thereby tending to urge it into its position against the inside face of the axially extending flange **32**. The connecting ring **46** is also provided with an annular flat face **48** which presses endwise against the transverse flange **31** when in assembled position.

For the purpose of connecting the parts together, the connecting ring **46** is provided with an exteriorly threaded sleeve **49** which extends through the passage **24** and the corresponding passage within the mounting gasket **17** to a position more or less flush with the inside face of the mounting gasket **17**. The fastening sleeve **13** which lies inside the receptacle **14** has an interiorly threaded portion **50** which extends into the passage through the mounting gasket **17** and threadedly engages the exteriorly threaded sleeve **49** of the connecting ring **46**. Wrench holes **51** may be provided to assist in rotating the fastening sleeve when the parts are assembled. In assembled condition a retaining edge **52** of the fastening sleeve overlies the washer **21** of the microphone bracket and perforce also overlies the mounting gasket **17** so that when it is screwed tightly into position the bead **22** will be forced into the mounting gasket to improve the seal so that the connection will be fully airtight. The force of application of the threaded members into engagement with each other at the same time draws the connecting ring against the mounting ring **30** and in turn presses the transverse flange **31** of the mounting ring into snug engagement with the exterior of the hard shell **18**, in turn pressing the hard shell into engagement with the mounting gasket **17**. This connection needs to be firm and positive but does not of necessity constitute the needed seal or sealing effect which is accomplished around the interior surface and the passage through the mounting gasket **17**. The attachment of the de-icer boot in the manner described, however, does form a firm, positive mechanical attachment which is necessary and needful in the device.

When the assembly is to be made, normally the valve housing **12** is extended into the de-icer boot from the outside end by spreading or flexing the walls outwardly until the housing is well within the boot to a position where the exteriorly threaded sleeve **46** extends through the passage within the mounting ring **30**. This combined sub-assembly then of the de-icer boot and the housing is applied to the exterior of the hard-shell so that the threaded sleeve **49** extends through the passage **24** and through the mounting gasket whereafter the fastening sleeve **13** is screwed into position until all parts are in firm, sealed assembly. Conversely, whenever disassembly might be needed, it is necessary only to unscrew the fastening sleeve, whereupon the de-icer boot and valve housing is released from the mask assembly **10**. Inasmuch as the de-icer boot assembly is a separate unitary part, all of the de-icer boots are interchangeable with the valve housings and both of these in turn are interchangeable with the mask assemblies. The parts thus described comprise accordingly a very useful composite device easily made up in respect to the component parts and in a form which renders sub-assembly as well as ultimate assembly a relatively simple non-complicated operation. Moreover, by reason of the fact that the entire exterior of the de-icer boot is entirely exposed, it can be very easily flexed by manipulation of the gloved hand of the user whenever it might be needed to dislodge ice which from time to time accumulates around the exterior of the valve housing as the device is operated in sub-zero surroundings.

The invention hereinabove described may be viewed as a split version type of oxygen mask. The valve assembly and hard-shell, when integrated with one another, provide a rigid platform for containing all the components of the basic mask assembly; whereas in pre-

vious concepts, valving has always been contained with rather flaccid rubber boss-like arrangements. Applicants' arrangement also provides for easy removal and replacement of the valving mechanism, hoses, etc., whereas in previous designs it has been a difficult problem because of the necessity to engage rather loose and pliable rubber bosses and compress them without the benefit of a rigid platform.

Further advantageous results stem from the simplification of the manufacturing procedure, as well as simplifying the tooling required for molding the rubber facepieces. When the need arises to mold a two-piece configuration of the type herein disclosed, the mold can be relatively simple with a minimum of moving parts, whereas in the case of a mask with an integrated de-icer boot the mold must be manufactured with at least several moving parts. This projects a problem of indexing and provides areas of potential wear.

In addition to the above, a two-piece mask construction simplifies the manufacture of the hard-shell configuration because of simplifying the tooling. Basically, the configuration required for a split version mask allows a simple conical shape with a minimum of drafting problems. If it is elected to mold the hard-shell, as has been done in the past, the tooling will be considerably simpler by virtue of the lack of necessity to project the de-icer boot protective hard-shell.

While the invention has herein been shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described the invention, what is claimed as new in support of Letters Patent is:

1. A breathing mask assembly comprising an oro-nasal receptacle of flexible material having a chamber therein, a face contacting sealing gasket on one side of the receptacle and a hose attachment area on the other side thereof, an annular mounting gasket for a supply tube on said other side defining an inhalation-exhalation passage, a de-icer boot comprising an annular mounting ring adapted to be positioned against said hose attachment area, a sleeve of flexible material having a free outside end and an inside end, said sleeve comprising an exterior wall having an inside end impressed against the exterior of said mounting ring and an interior wall having an inside end lying against the interior of said mounting ring, outside ends of said walls being joined together and enclosing an insulating space between said walls, a supply tube having an inhalation-exhalation valve housing thereon, said housing having a position within said boot, said housing comprising a connecting ring having a cylindrical exterior positioned against the inside end of the interior wall and an end face in engagement with the mounting ring, and a fastening sleeve having a retaining edge overlying the inside of said mounting gasket, said fastening ring having a threaded engagement with said connecting ring of the valve housing whereby said de-icer boot and the valve housing are simultaneously releasably attached to the receptacle in sealed position around the inhalation-exhalation passage.

2. A breathing mask assembly comprising an oro-nasal receptacle of flexible material having a chamber therein, a face contacting sealing gasket on one side of the receptacle and a hose attachment area on the other side thereof, an annular mounting gasket for a supply tube on said other side defining an inhalation-exhalation passage, a de-icer boot comprising a mounting ring having an annular relatively flat transverse flange adapted to be positioned against said end face of the hard shell and having an annular axially extending flange at the outer perimeter, a sleeve of flexible material having a free outside end and an inside end, said sleeve comprising an exterior wall having an inside end impressed against the exterior of said axially extending flange and an interior wall having an inside end lying against the interior of said axially extending flange, outside ends of said walls being joined together and enclosing an insulating space between said walls, a supply tube having an inhalation-exhalation valve housing thereon, said housing having a position within said boot, said housing comprising a connecting ring having a cylindrical exterior positioned against the inside end of the interior wall and an end face in engagement with the transverse flange of the mounting ring, and a fastening sleeve having a retaining edge overlying the inside of said mounting gasket, said fastening ring having a threaded engagement with said connecting ring of the valve housing whereby said de-icer boot and the valve housing are simultaneously releasably attached to the receptacle in sealed position around the inhalation-exhalation passage.

3. A breathing mask assembly comprising an oro-nasal receptacle of flexible material having a chamber therein, a face contacting sealing gasket on one side of the receptacle and a hose attachment area on the other side thereof, an annular mounting gasket for a supply tube on said other side defining an inhalation-exhalation passage and a hard shell extending over the exterior of the receptacle including an end face having a passage therethrough coinciding with said inhalation-exhalation passage, a de-icer boot comprising an annular mounting ring adapted to be positioned against said end face of the hard shell, a sleeve of flexible material having a free outside end and an inside end, said sleeve comprising an exterior wall having an inside end impressed against the exterior of said mounting ring and an interior wall having an inside end lying against the interior of said mounting, outside ends of said walls being joined together and enclosing an insulating space between said walls, a supply tube having an inhalation-exhalation valve housing thereon, said housing having a position within said boot, said housing comprising a connecting ring having a cylindrical exterior positioned against the inside end of the interior wall and an end face in engagement with the mounting ring, and a fastening sleeve having a retaining edge overlying the inside of said mounting gasket, said fastening ring having a threaded engagement with said connecting ring of the valve housing whereby said de-icer boot and the valve housing are simultaneously releasably attached to the receptacle and the hard shell in sealed position around the inhalation-exhalation passage.

4. A breathing mask assembly comprising an oro-nasal receptacle of flexible material having a chamber therein, a face contacting sealing gasket on one side of the receptacle and a hose atachment area on the other side thereof, an annular mounting gasket for a supply tube on said other side defining an inhalation-exhalation passage and a hard shell extending over the exterior of the receptacle, said hard shell including a flat end face having a passage therethrough coinciding with said inhalation-exhalation passage, a de-icer boot comprising a mounting ring having an annular relatively flat transverse flange adapted to be positioned against said end face of the hard shell and having an annular axially extending flange at the outer perimeter, a sleeve of flexible material having a free outside end and an inside end, said sleeve comprising an exterior wall having an inside end impressed against the exterior of said axially extending flange and an interior wall having an inside end lying against the interior of said axially extending flange, outside ends of said walls being joined together and enclosing an insulating space between said walls, a supply tube having an inhalation-exhalation valve housing thereon, said housing having a position within said boot, said housing comprising a connecting ring having a cylindrical exterior positioned against the inside end of the interior wall and an end face in engagement with the transverse

flange of the mounting ring, a microphone bracket in the chamber having a portion thereof overlying said mounting gasket and surrounding said inhalation-exhalation passage, and a fastening sleeve having a retaining edge overlying said portion of the bracket and the inside of said mounting gasket, said fastening ring having a threaded engagement with said connecting ring of the valve housing whereby said de-icer boot and the valve housing are simultaneously releasably attached to the

receptacle and the hard shell in sealed position around the inhalation-exhalation passage.

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