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54 **Safety helmet.**

57 The invention relates to a combined safety helmet and breathing apparatus and recognises the inherent problem with all such prior art combinations, that the wearer is totally dependent on the breathing apparatus for breathable air for the whole of the time the helmet is in use.

The present invention proposes overcoming this problem by providing an air passage (29, or 48) which, when open, connects the breathable volume in the helmet with the surrounding atmosphere and which air passage (29, or 48) is closeable by a valve member (30, or 49) to prevent contamination of the breathable volume by the surrounding atmosphere via the said air passage (29, or 48) when the breathing apparatus is in use.

The air passage (29, or 48) and its associated valve member (30, or 49) may be independent of, or incorporated into, the exhalation valve (41 to 47) for venting spent air to the surrounding atmosphere when the breathing apparatus is in use.

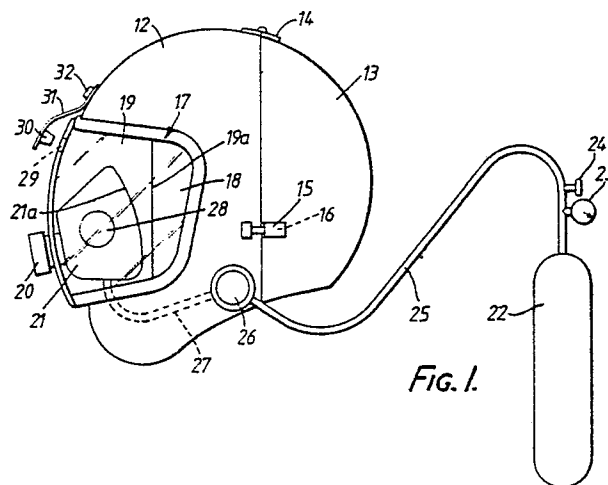


Fig. 1.

EP 0 325 959 A2

SAFETY HELMET

The present invention relates to a safety helmet of the type designed to totally encase the head of the wearer and to include a breathing apparatus to protect the wearer against a harmful atmosphere.

Such helmets are provided with an air supply; the wearer inhaling with the air thus provided and exhaling to atmosphere through a valve in the helmet.

A disadvantage of such existing safety helmets is that the exhalation valves are strictly one way and therefore the wearer is breathing from the air supply at all times, even in circumstances in which it would be safe to breathe the surrounding atmosphere. Continuous reliance on the breathing apparatus is not only uncomfortable for the wearer but it can also greatly reduce the effective safe stay time in an adverse atmosphere when the breathing apparatus is a fixed volume reservoir.

An object of the present invention is to provide a safety helmet including an exhalation valve which can also be used without the wearer being dependent on the breathing apparatus.

According to the present invention there is provided a combined safety helmet and breathing apparatus, the helmet defining a breathable volume supplied with breathable air by the breathing apparatus and including an exhalation valve for venting spent air to the surrounding atmosphere, characterised in that the helmet includes an air passage connecting the said breathable volume with the surrounding atmosphere and valve means for opening and closing said air passage.

It will be appreciated that when the displaceable member is in the position opening the said air passage, the wearer of the helmet can inhale through the air passage and also, if need be, exhale through it.

Preferably the valve means is in the field of view of a person wearing the helmet and the valve means includes different visual presentations, in the field of view of the wearer, for the open and closed positions for said valve means.

In one embodiment in accordance with the invention the said air passage and its associated valve means are independent of the exhalation valve.

In another embodiment the exhalation valve includes the said air passage and a valve member displaceable between a first position, in which it closes said air passage, and a second position in which it opens said air passage.

Preferably the exhalation valve comprises one-way exhalation valve elements, are substantially concentric with a central axis for said valve, a

plurality of said air passages are equi-spaced about a pitch circle generally concentric with said central axis for the exhalation valve and said air passages are closed and opened by a common valve element generally concentric with said central axis. In such an embodiment the said common valve element is preferably displaceable in the direction of said central axis between its positions defining the air passageways open and closed conditions.

Preferably the, or a, said air passage includes means to emit an audible warning when said air passage is open and air is passing therethrough.

The invention will now be described further by way of example with reference to the accompanying drawings in which:

Fig. 1 shows a side view of a safety helmet and breathing apparatus the helmet being provided with an air passage and valve means therefore in accordance with the invention.

Fig. 2 shows a vertical cross section, passing through the central axes, through an exhalation valve in accordance with the invention.

In the embodiment illustrated in Fig. 1 a safety helmet, generally indicated by numeral 11, comprises two shell parts 12 and 13 connected by a hinge 14 and securable in its closed position by fasteners 15 and 16, one on each side of the helmet 11. An aperture 17 in the forward regions of the shell part 12 is closed by a see-through panel 18 and an annular seal 19, internally of the helmet 11, has one end edge region sealed to the helmet 11 around the aperture 17 and the seal 19 extends therefrom inwardly of the helmet to its other side edge region 19a.

The helmet 11 described thus far is of conventional form and is known in the art and, thereby, no further detailed description of the helmet, its fasteners or the arrangement of the viewing aperture is necessary.

The helmet 11 is fitted by hinging the shell parts 12 and 13 away from one another, fitting the helmet onto the head of the wearer, closing the shell parts 12 and 13 to totally encase the head of the wearer and securing the fasteners 15 and 16 to retain the shell parts 12 and 13 in the closed position.

With the helmet 11 so fitted the side edge 19a of seal 19 is in continuous contact with the face of the wearer, said edge 19a extends across the forehead, down the cheeks and across the chin of the wearer, thereby forming a seal. Thus, that volume within the helmet defined by the panel 18, the seal 19 and the face of the wearer is isolated from the remainder of the interior of the helmet and as the

wearer's breathing ducts (nostrils and mouth) open to said isolated volume said volume essentially defines the breathable volume within the helmet 11 isolated from the remainder of the interior of the helmet.

The helmet 11 also includes an exhalation valve 11, which passes through the panel 18, and a nose cone 21 the inner edge regions 21a of which (most remote from the panel 18) surround the breathing apertures of the wearer, thus defining a second volume within the breathable volume.

Air is supplied to the helmet 11 from a reservoir 22 the outlet from which includes a pressure gauge 23 and a shut off valve 24 and extends, via a flexible hose 25, to a demand valve 26 attached to the helmet 11.

When the pressure in the breathable volume falls below a pre-determined pressure the demand valve 26 opens to port air, via a duct 27 within the helmet 11, through an opening in the seal 19 to the breathable volume and the valve 26 closes when the pressure in the breathable volume attains a pre-determined pressure.

The nose cone 21 includes a one way valve 28 which opens when the pressure in the nose cone falls below the pressure in the breathable volume, thus to allow air flow from the breathable volume into the nose cone 21, and said valve 28 closes when the pressure in the nose cone 21 is greater than the pressure in the breathable volume.

When the shut off valve 24 is open to connect the air in reservoir 22 to the demand valve 26 on the wearer inhaling the pressure in the nose cone 21 falls below the pressure in the breathing volume surrounding the nose cone 21 and air flows from the breathing volume through the valve 28 into the nose cone 21. As the pressure in the breathable volume falls below the pre-determined level the valve 26 opens and air is supplied from the reservoir 22 through valve 26 to the breathable volume until said volume attains the predetermined upper value when the valve 26 closes.

When the wearer exhales the pressure in the nose cone 21 exceeds the pressure in the breathable volume, whereupon the valve 28 closes and the exhalation valve opens so that the exhaled air flows through the exhalation valve 21 to atmosphere.

It will be seen that with the above described arrangement the wearer is totally reliant upon the breathing apparatus at all times and when for example on stand-by or working in a breathable atmosphere prior to entering an adverse atmosphere the wearer is constantly drawing upon the air in reservoir 22. This means that when the wearer enters the hazardous atmosphere the amount of air available in reservoir 22 has been reduced so that the stay time in the adverse atmosphere is limited.

Further, leaving an adverse atmosphere the

wearer may well be in a breathable atmosphere but unable, or unwilling, to remove the helmet because of the danger of, for example, falling objects and if at this point the air available in reservoir 22 should fall below a safe pressure the life of the wearer can be endangered.

To avoid these dangers the helmet illustrated in Fig. 1 includes an aperture 29 through the upper regions of the see-through panel 18 which, when opened, allows the free flow of air from atmosphere to the breathable volume, and the aperture 29 is closeable by a resilient plug 30, captive on a flexible strap 31 attached to the helmet by a rivet 32. The strap 31 may be pivotable on the rivet 32.

Thus, with this arrangement, when the wearer is in a breathable atmosphere the plug 30 can be removed from the aperture 29 and the plug and strap 31 rotated about the pivot pin 32 out of the view of the wearer, the valve 24 can be closed and the wearer can rely on the breathable atmosphere entering through the aperture 29 into the breathable volume so that no demands are made on the reservoir 22.

When the wearer is to enter an adverse atmosphere the valve 24 can be opened, the strap 31 and plug 30 rotated about the pin 32 until the plug is located for engagement in the aperture 29 and with the plug 30 closing the aperture 29 the breathable volume is totally isolated from the adverse atmosphere and the wearer again becomes dependent upon the breathing apparatus including the reservoir 22.

It should be noted that the plug 30 and strap 31 will be in view of the wearer when the plug 30 is closing the aperture 29 and thus only a visual inspection is necessary to insure that the aperture 29 is closed before the wearer enters the adverse atmosphere. Further, when the wearer leaves the adverse atmosphere the plug 30 can be removed from the aperture 29 and rotated away from the field of vision of the wearer and the valve 24 can be closed so that the wearer can again depend upon the air of the surrounding atmosphere.

It will be observed that by providing the facility to breathe breathable atmosphere the wearer can wear the helmet 11 for an indefinite period and will only make demands on the reservoir 22 when entering and within an adverse atmosphere.

Referring now to Fig. 2, the embodiment comprises an annular valve body 41 having mounted within the annulus thereof a diaphragm valve assembly, generally indicated at 42, and bearing a screw-thread 43 on the outer, axially directed, annular surface 44 thereof. The thread 43 receives a screw-threaded ring 45 by which an annular seal 46, which may be part of a nose cone similar to that nose cone 21 in Fig. 1, is compressed between the see-through panel V of the helmet and

thering 45 to form an hermetic seal against the interior surface of the see-through panel V of the helmet. The body 41 provides a radially outwardly directed flange 47 to bear against the exterior surface of the helmet visor V.

The valve as so far described is of conventional exhalation valve design.

The embodiment further comprises, formed in the body 41, four equi-angularly spaced bores 48 on a common pitch circle concentric with the axis of the body 41, passing axially through the body and forming passages by-passing the diaphragm valve 42 and permitting, when unobstructed, air to pass between the interior and exterior of the helmet in which the valve is installed.

A displaceable member in the form of a ring 49 has an annular extension 50 of such external diameter such as to form a sliding fit within a complementary annular recess 51 formed on the valve body 41. The ring 49 is externally of the panel V whereby, by manual action the ring 49 can be axially displaced between a first position (as shown in the Fig. 2) and a second position axially outwardly thereof and towards the left as viewed in Fig. 2. To hold the ring 49 in whichever of the first and second positions it is moved to, the ring 49 includes a locking ring 52 seating in one or the other of two annular grooves 53, serving as detents for ring 49.

The annular extension 50 carries on its axially inward face (that face within the sleeve 51) an annular seal 54 which, when the ring 49 is stationed in the first position, seals the four axial bores 48 provided in the valve body 41 against passage of air either way therethrough but which, when the ring 49 is displaced to the second position, is drawn clear of the bores 41 to permit the passage of air freely therethrough.

In the first position of the ring 49, the valve of the embodiment acts simply as an exhalation valve in the same manner as a conventional exhalation valve.

In the second position of the ring 49 the valve of the embodiment acts as an inhalation valve allowing air to flow from atmosphere to the breathing volume in the helmet, via the bores 48. These bores 48 also permit exhalation therethrough when the ring 49 is in its said second position.

As will now be appreciated the exhalation valve proposed allows the wearer of the helmet to manually displace the ring 49 to its second position, in which it permits the passage of air therethrough, when the wearer is in a breathable atmosphere, thus to conserve the air supply to the helmet. Before entering a dangerous atmosphere for the wearer it is only necessary to switch on the air supply to the helmet and displace the ring 49 to its first position, in which the air passages are bloc-

ked, so that the wearer now breathes only the air supplied to the helmet from the supply source.

The valve is completed by a mesh panel 56.

With such an arrangement it is always possible that the wearer when approaching a harmful atmosphere will forget, or be distracted from, displacing the ring 49 to its first position, thus closing the air bores 48 in the exhalation valve. When the helmet air supply is such that the breathable atmosphere within the helmet is always in excess of atmospheric pressure there is little danger of the wearer of the helmet breathing the harmful atmosphere but there will be a continuous loss of atmosphere from the breathing volume within the helmet to the surrounding atmosphere.

To avoid this possibility one, or more, of the spaced bores 11 defining the air passageways may be shaped (not shown) to emit audible warning when air is passing through the bore, or one or all of the bores may include a device, generally indicated by numeral 55 arranged to emit audible warning by flow of air therethrough. Preferably the audible warning devices are not only audible to the wearer of the helmet but also to adjacent personnel.

Thus, with this arrangement, the wearer and personnel in the vicinity of the wearer will always be aware when the air passageways are open and the wearer is breathing the surrounding atmosphere, so that due warning can be given if the wearer unconsciously enters the harmful environment with the air passageways open.

Preferably also the exhalation valve will include a visual warning when the air passages are open and, by way of example, the radial face 49a of the ring 49 facing the helmet may be distinctly coloured so as to be easily seen by the wearer only when the ring 49 is in its said second position.

Claims

1 A combined safety helmet and breathing apparatus, the helmet defining a breathable volume supplied with breathable air by the breathing apparatus and including an exhalation valve for venting spent air to the surrounding atmosphere, characterised in that the helmet includes an air passage connecting the said breathable volume with the surrounding atmosphere and valve means for opening and closing said air passage.

2 A combined safety helmet and breathing apparatus according to claim 1, characterised in that the valve means is in the field of view of a person wearing the helmet and the valve means includes different visual presentations, in the field of view of the wearer, for the open and closed positions for said valve means.

3 A combined safety helmet and breathing apparatus according to claim 1 or 2 characterised in that said air passage and its associated valve means are independent of the exhalation valve.

4 A combined safety helmet and breathing apparatus according to claims 1 or 2 characterised in that the exhalation valve assembly includes the said air passage and a valve member displaceable between a first position, in which it closes said air passage, and a second position in which it opens said air passage.

5 A combined safety helmet and breathing apparatus according to claim 4 characterised in that the exhalation valve comprising one-way exhalation valve elements are substantially concentric with a central axis for said valve, a plurality of said air passages are equi-spaced about a pitch circle generally concentric with said central axis for the exhalation valve and said plurality of said air passages are opened and closed by a common valve element generally concentric with said central axis.

6 A combined safety helmet and breathing apparatus according to claim 5 characterised in that the said common valve element is displaceable in the direction of said central axis between its positions defining the air passageways open and closed conditions.

7 A combined safety helmet and breathing apparatus according to any preceding claim characterised in that the, or a, said air passage includes means to emit an audible warning when said air passage is open and air is passing therethrough.

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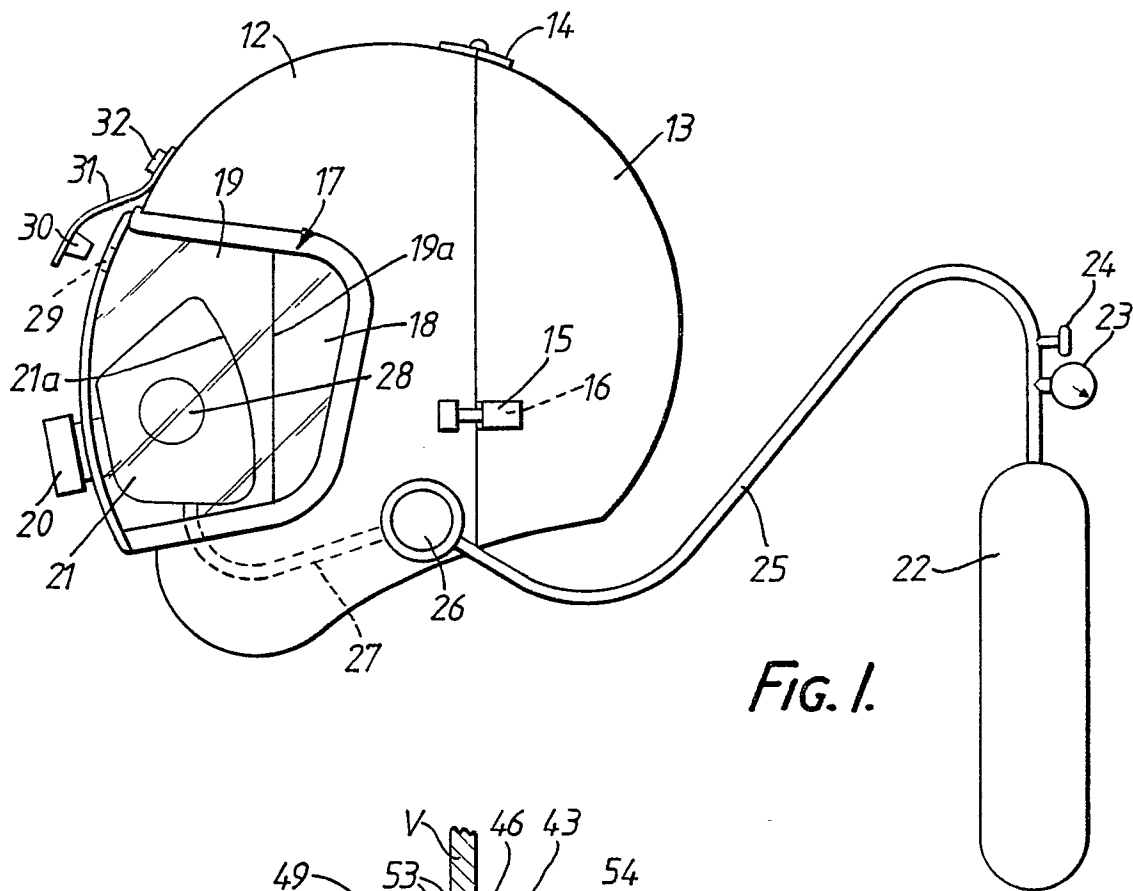


FIG. 1.

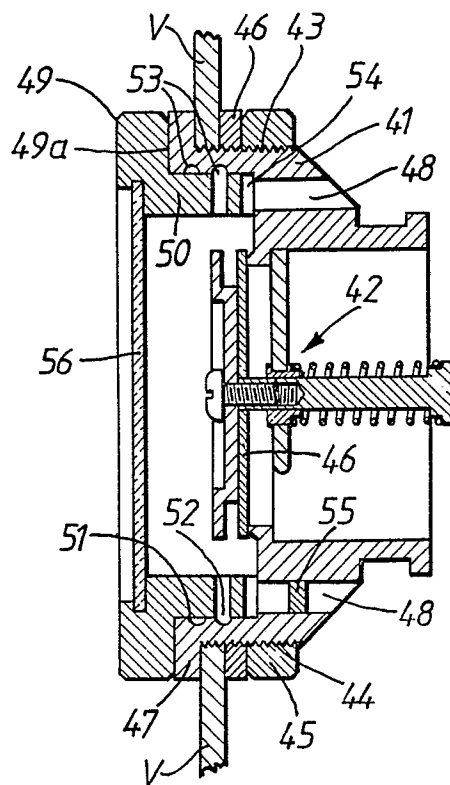


FIG. 2.