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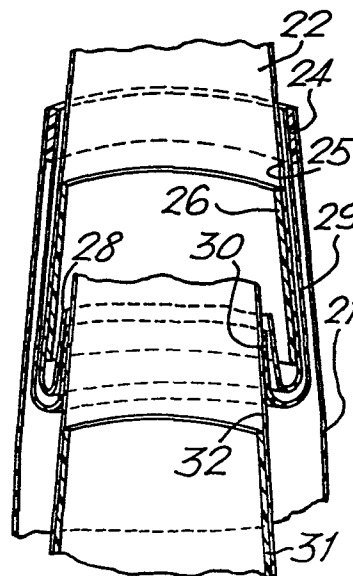
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⑤④ **Protective clothing.**

⑤⑦ A suit of protective clothing has a ring at each sleeve end and within which a frusto-conical gauntlet lining of the glove makes a seal enhanced by outward pressure on the glove. The glove end portion and/or that of an inner sleeve extending from the ring can be turned around the ling end and sealed by a frusto-conical portion of an inner glove. A breathing mask can be likewise sealed against a sealing ring around an aperture in the suit, or an integral visor, provided with spaced outer and inner anti-misting panels between which pressure air is caused to flow, can be provided. The trouser legs have external tubes which fold up within themselves to the tops of boots within which the legs are received.



-1-

PROTECTIVE CLOTHING

DESCRIPTION

The invention relates to protective clothing such as is worn in hazardous environments to protect the wearer from dangerous fumes and/or liquids.

Such protective clothing may comprise a suit which
5 must be worn with gloves, boots and a breathing mask. To obtain a required degree of protection, effective seals must be established between these clothing components and the invention is concerned with the provision of sealing arrangements which are inexpensive
10 to produce and simple to use whilst affording seals of appropriate integrity.

In accordance with the invention, there is provided a suit of protective clothing having sealing means between a glove and the free end of a sleeve of the suit,
15 the sealing means comprising first and second annular sealing members associated respectively with the sleeve and the glove, the second sealing member being receivable within the first, and at least one of the first and second sealing members tapering inwardly in
20 the outward direction so that the sealing members are sealingly urged together in use by outward pressure on the glove.

Conveniently, the gauntlet portion of the glove has an end portion extending beyond the second sealing
25 member, the end portion being turned over in use to extend within the second sealing member. An inner sleeve can extend inwardly of the sleeve from the first

sealing member, the end portion of the inner sleeve being turned over in use to extend within the second sealing member. At least one additional inner glove with a frusto-conical gauntlet for reception within the
5 second sealing member, to secure the or each end portion within the second sealing member.

The invention also provides a suit of protective clothing having a seal between respective components thereof, the seal comprising a first sealing member
10 extending around an opening in one of the components, a second sealing member constituting or secured to the other component being received in or through the opening, and the components being urged together in use in a manner to ensure a seal between the sealing members.
15 The first sealing member can comprise a generally flat ring of closed all material positioned around an aperture in the head portion of the suit and the second sealing member is constituted by a breathing mask received in the aperture.

20 The invention also provides a suit of protective clothing having a visor comprising spaced apart transparent inner and outer panels and means for supplying air under super-atmospheric pressure to the space between the panels.

25 Also in accordance with the invention, a trouser leg of a protective suit is provided with an outer sleeve portion which can be folded up within itself and releasably secured to the leg portion of a boot within which the trouser leg proper is received. The free end
30 of the outer sleeve portion can thus be provided with a ring of touch and close fastener material by which it can be secured to a ring of mating fastener material at the outer side of the upper end of the boot leg portion.

The invention is further described below by way of
35 example with reference to embodiments thereof schematically shown in the accompanying schematic drawings, in which:

Figure 1 is a front view of a hood portion of a

suit of protective clothing sealed around a face aperture thereof to a breathing mask;

Figure 2 is a partial sectional view of the free end of a sleeve of the suit sealed to a gauntlet portion
5 of a glove received therein;

Figure 3 is a like view of a modified means for sealing a sleeve of the suit to a gauntlet portion of a glove received therein, the component parts being shown spaced apart in a position prior to completion of the
10 seal;

Figure 4 is an interior perspective view of a visor for incorporation in a modified hood portion of the suit;

Figure 5 is a partial sectional side view of the visor of Figure 4, taken on the line V-V of Figure 4;
15 and

Figure 6 is a partial sectional front view of a trouser portion of the suit received in the leg portion of a boot and externally connected thereto.

Figure 1 shows the hood portion 1 of a suit 2 of
20 protective clothing. The suit 2 and the related clothing components yet to be described can be made of any suitable liquid and gas impervious sheet material; for example PVC, neoprene or natural rubber, depending on the environment from which protection is required. It is assembled from
25 appropriately cut panels by bonded seams, which can be reinforced by stitching, and over which sealing strips can be secured by adhesive. The hoodportion 1 is provided with an aperture around which extends a face seal 4 in the form of a flat split annular or C-shaped ring, :
30 sealingly secured around its outer periphery to the material of the hoodportion as by adhesive and or stitching (not shown). The suit 2 comprises, besides the hood portion 1, a body portion, and arm and leg portions, and the wearer puts it on and takes it off by means of an
35 opening extending downwardly from the division of the face seal. This opening can be closed by a zip fastener 5,6 which extends to the inner periphery of the face seal 4. An integral flap portion 8 of the suit on one

side of the opening can be extended over the zip fastener when this is closed, and can be secured to the other side of the suit by means of a touch-and-close fastener, preferably of the kind sold under the registered trade mark Velcro by Selectus Limited. Conveniently, a length 9 of looped Velcro fastener extends parallel to and spaced from one edge of the opening and a length 10 of mating hook or mushroom Velcro fastener underlies the edge of the flap portion 8. If preferred, spaced press stud fasteners can replace the touch and close fasteners.

In use, the wearer first puts on a breathing mask 11 which incorporates a visor portion 12 and an air supply connection 14 through which air is supplied to the wearer through demand valve. The wearer then enters the suit 2, and closes the zip fastener 5,6 to close the suit and bring together the two ends of the face seal 4.

The shape of the hood portion 1 is such that the surface of the face seal 4 is consequently urged over its entire exposed width against the face mask 11. The face seal 4 is of a resiliently stretchable flexible closed cell foam material, for example neoprene or rubber, so as to be impervious to liquid and gases. Because of the compressive engagement of the seal 4 with the face mask 11, a seal is obtained against entry of fluids through the join between the face mask and the suit head portion 1.

To ensure the integrity of this seal should the zip fastener 5,6 become loosened at the join of the ends of the face seal 4, a securement flap 15 is provided. This comprises a short length of the material of the face seal 4 bonded at 16 to the outer side of the seal and provided at its free end with one element 17 of a Velcro or other touch-and-close fastener, by which it can be releasably connected in use to a mating fastener element 18 secured to the outer side of the face seal, on the other side of the zip fastener 5,6.

It will be appreciated that the sealing arrangement described provides a seal which is entirely adequate for

a range of conditions under which protective clothing has to be worn, and which is extremely simple and inexpensive to provide. It is moreover very convenient in use, in particular because a suit on which it is provided can be
5 put on without the need for disconnection of the air supply connection to the face mask.

Figure 2 shows in cross-section the free end portion 21 of a sleeve of the protective clothing suit 1. The sleeve portion 21 is constructed so as to taper
10 inwardly towards its free end. The suit 1 is worn with gloves 22 and a seal has to be maintained in use between each of these gloves and the associated sleeve of the suit. In accordance with the invention, such a seal is effected by means of a ring 24 the material of which can
15 be the same as or similar to that of the face seal 4 of Figure 1. Instead, the ring 24 can be of relatively rigid material, for example plastics material, lined over at least its internal face with the material of the face seal 4, or with other material capable of making a
20 seal. The ring 24 is of circular cylindrical or frusto-conical shape.

The glove 22 is provided with a gauntlet portion 25 having secured therein as by adhesive and/or stitching (not shown) a frusto-conical reinforcement member 26 of
25 stiff but resiliently deformable material. The gauntlet portion 25 can but need not be extended beyond the larger diameter end of the member 26 as shown at 28, to be turned inwardly in use and form an elasticated restriction around the wrist of the wearer. The ring 24
30 is secured either to the gauntlet portion 25 or to the sleeve portion 21 so as to be received by them adjacent the opening of the sleeve portion.

The glove 22 can be readily assembled with and disassembled from the sleeve 21 by inward deformation of
35 the member 26 along an axial line so that its effective cross sectional area is less than that of the opening of the sleeve portion 21. In use, outward urging of the glove 22 by the user's hand and arm will tend to compress

the ring 24 and so enhance the seal it provides.

Again, an effective seal is provided in an economical way in components of protective clothing which are conveniently handled by the user.

5 Figure 3 shows a modified arrangement for effecting a seal between the glove 22 and the sleeve 21. The sleeve 21 is again provided with the ring 24, and the glove 22 again includes within its gauntlet portion 25 the frusto-conical reinforcement member 26. An internal
10 inner sleeve 29, suitably of the same material as the sleeve 21, however now extends into this sleeve from the inner face of the ring 24. The free end of the inner sleeve 29 extends beyond the larger diameter end of the member 26, so that its end portion 30 can be
15 turned inwardly as shown, in the same way as the end portion 28 of the gauntlet portion 25.

In the arrangement of Figure 3, the seal is effected as before between the glove 22 and the inner face of the ring 24, but the sealing assembly is locked in place by
20 means of a second hollow frusto-conical member 31, suitably of the same material as the member 26. The member 31 is shaped to be received within the member 26, with the end portions 28 and 30 between the two members.

The member 31 is preferably secured within the
25 gauntlet portion of a secondary inner glove 33 for example of thin rubber sheet material, which is received in use within the glove 22, to provide additional protection.

It will be evident that the Figure 3 arrangement
30 enhances the security of the seal, which can be gas-tight and is consequently suitable for use in a gas-tight, fitted with a gas-tight zip fastener. If desired, a further member of the same general form as the member 31 can be received within the member 31, in the same way
35 as the member 31 is received within the member 26, the gauntlet portion of the glove 32 being then extended beyond the inner end of the member 31 to be folded up to provide an end portion corresponding to the portion 28

of the glove 22. This further frusto-conical member can be secured within a tertiary glove if required.

Figures 4 and 5 show a visor which can be incorporated into a modification of the hood 1, in which
5 the user's breathing apparatus is located within the suit 2. The visor comprises an outer transparent panel 40 of suitably tough material, for example non-plasticated semi-rigid PVC, of generally rectangular shape, but formed into a part cylindrical shape. Such a panel if
10 used on its own would be liable to be quickly obscured by condensed vapour from the user's breathing within the hood, and this problem is solved by the provision of an internal panel 41, of the same shape as the panel 40, but of non-misting material, for example an acetate sheet.
15 The panel 41 can be a lining to the panel 40 but panels 40 and 41 are preferably assembled together in spaced apart relationship, as by means of a rubber grommet 42 which extends right around the peripheries of the panels and projects beyond them, to permit the visor to be
20 permanently assembled with the material of the hood 1. To maintain the required shape of the visor, the upper and lower edges are reinforced by curved rigid bars 45 and 46, for example of aluminium, held in place by rivets through them, the panels 40 and 42 and the grommet 44.
25 The space between the panels 40 and 42 may be sealed tight by the bonding of the grommet 44 to the panels. Alternatively however, the space between the panels 40 and 42 can be in communication with air under super-atmospheric pressure, and the space can be vented
30 so as to provide an airflow therethrough. The super atmospheric air provides additional protection for the user in the event of a break in the outer panel 42. Thus, the lower edge portion of the grommet 44 can be provided with an air inlet tube 48, which is connected
35 with the air supply to the breathing apparatus worn by the user of the suit, or to the external airline where the suit is pressurised by an external air supply.

An outlet tube 49, fitted with a non-return valve, for the air introduced into the space between the panels 40 and 42 is provided at the top of the visor.

Figure 6 shows a trouser leg portion 51 of the
5 suit 1, which extends to an underfoot loop at its free end (not shown), and is received in the leg portion 52 of a boot. To provide against the entry of liquids into the boot, the leg portion 51 is provided with an outer tube portion 54 which extends downwardly from a position
10 above the top of the boot portion 52. The tube portion 54 is turned upwardly within itself and is secured at its free end to the exterior of the boot portion 52 by means of Velcro or other touch-and-close fastener elements 55, 56 secured to the respective portions. The free end of
15 the tube portion 54 can be elasticated to engage the boot and an elasticated ring 58 can be provided within the fold of the tube portion.

A boot can be readily adapted for use with a suit provided with the tube portion 54 and the fastener
20 element 55, if a mating fastener element with a self-adhesive backing is provided for attachment to the boot to provide the element 56.

The invention can of course be embodied in a variety of different ways from those specifically
25 illustrated and described.

CLAIMS:

1. A suit of protective clothing having sealing means between a glove (22) and the free end of a sleeve (21) of the suit, characterised in that the sealing means comprises first and second annular sealing members (24,26) associated respectively with the sleeve and the glove, the second sealing member (26) being receivable within the first, and at least one (26) of the first and second sealing members being of inwardly tapering cross-section in the outward direction, so that the sealing members are sealingly urged together in use by outward pressure on the glove (22).

2. A suit as claimed in claim 1 wherein the first sealing member (24) comprises a rigid right circular cylinder, and the second sealing member (26) comprises a frusto-conical gauntlet portion.

3. A suit as claimed in claim 1 or 2 wherein the gauntlet portion of the glove has an end portion (28) extending beyond the second sealing member (24), the end portion being turned over in use to extend within the second sealing member.

4. A suit as claimed in claim 1, 2 or 3 wherein an inner sleeve (29) extends inwardly of the sleeve (20) from the first sealing member (24), the end portion (30) of the inner sleeve being turned over in use to extend within the second sealing member.

5. A suit as claimed in claim 3 or 4 having at least one additional inner glove (32) with a gauntlet portion (30) arranged for reception within the second sealing member (26) to secure the or each end portion (28,30) within the second sealing member.

6. A suit as claimed in any preceding claim wherein the second sealing member (26) can be readily collapsed to allow it to be moved through the first sealing member when required.

7. A suit of protective clothing having a seal between respective components thereof, the seal comprising a first sealing member extending around an opening in

one of the components, a second sealing member
constituting or secured to the other component being
received in or through the opening, and the components
being urged together in use in a manner to ensure a seal
5 between the sealing members.

8. A suit as claimed in claim 4 wherein the first
sealing member comprises a generally flat ring of closed
all material positioned around an aperture in the head
portion of the suit and the second sealing member is
10 constituted by a breathing mask received in the aperture.

9. A suit of protective clothing having a visor,
the visor being characterised by spaced apart trans-
parent inner and outer panels (42,40) and means (48)
for supplying air under super-atmospheric pressure to
15 the space between the panels.

10. A suit as claimed in claim 9 having outlet
means for the super-atmospheric air, so that the space
between the panels is swept by a flow of the air.

11. A suit as claimed in claim 9 or 10 wherein
20 the inner panel is of anti-misting material.

12. A suit of protective clothing having a trouser
leg (51) for releasable connection to a boot (52),
characterised in that the trouser leg is provided with
an outer tube portion (54) arranged to be folded up
25 within itself and releasably secured to the leg portion
(51) of the boot when the trouser leg is received
within the boot.

FIG.1.

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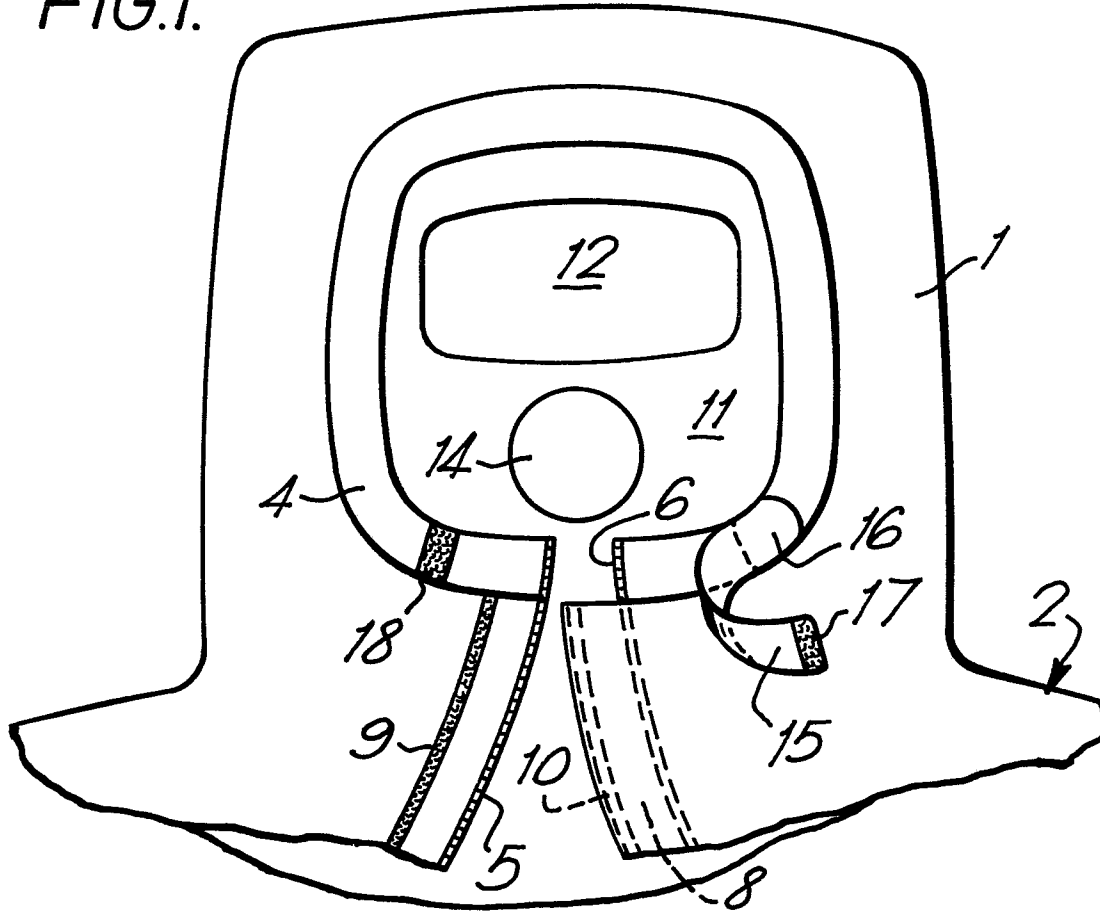


FIG.2.

FIG.3.

