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(54) Protective clothing

(57) A suit for use in contaminated areas to isolate its wearer from the environment within those areas has three parts. The first part includes the covering for the wearers head 6, arms 7 and upper body and is releasably fitted around an opening 4 into the contaminated area. The second part 9 includes the legs 10 of the suit and is releasably connectible to the first part of the suit to enclose the wearer who

is then supplied with air through a umbilical pipe 17. A further part 12 surrounds the second part and is releasably connectible to it to enclose a space 16 between the parts. The further part 12 is also releasably connectible to the opening 4 to prevent egress from the contaminated area when the wearer is in the area in the suit. The releasable connections between the parts may be bayonet type fittings or may be rotating T-shaped projections which engage in T-shaped grooves.

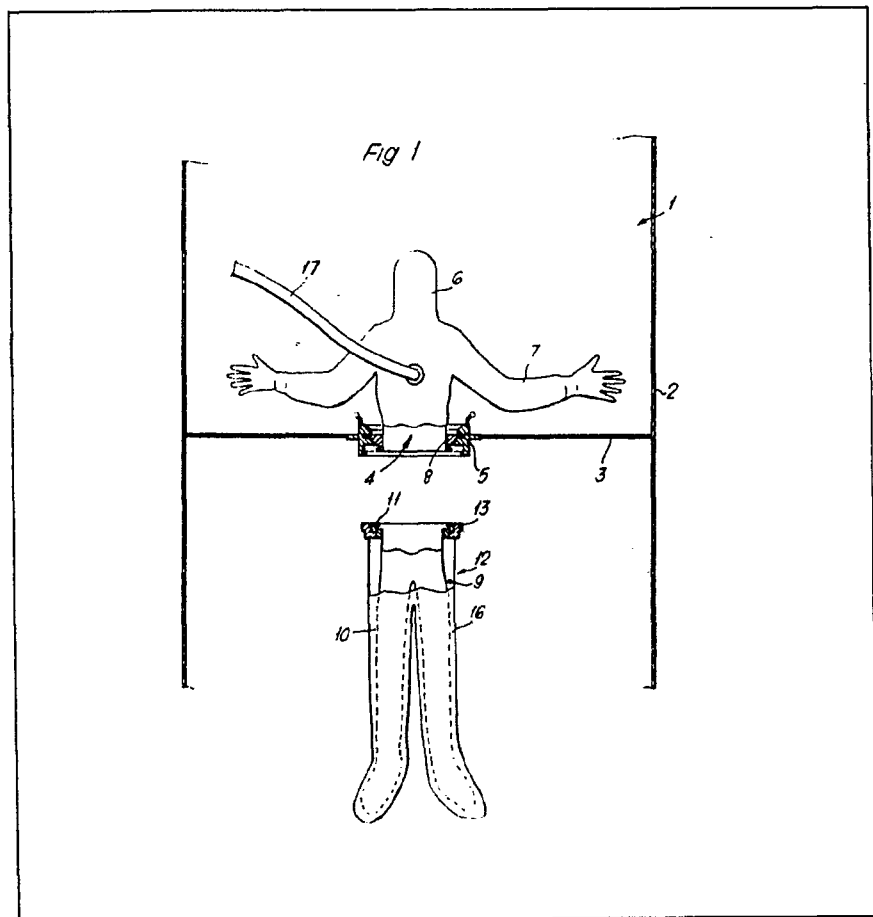
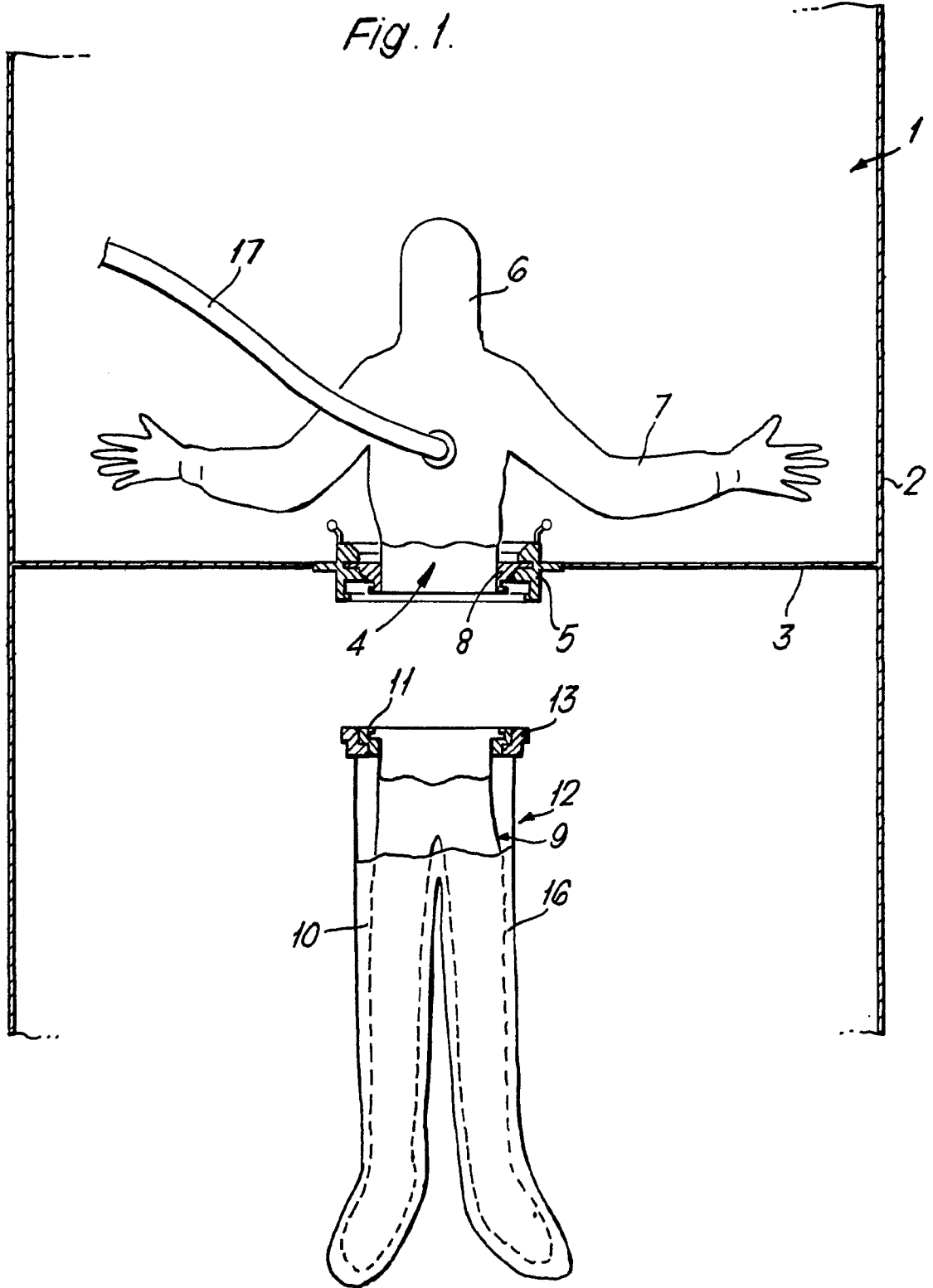
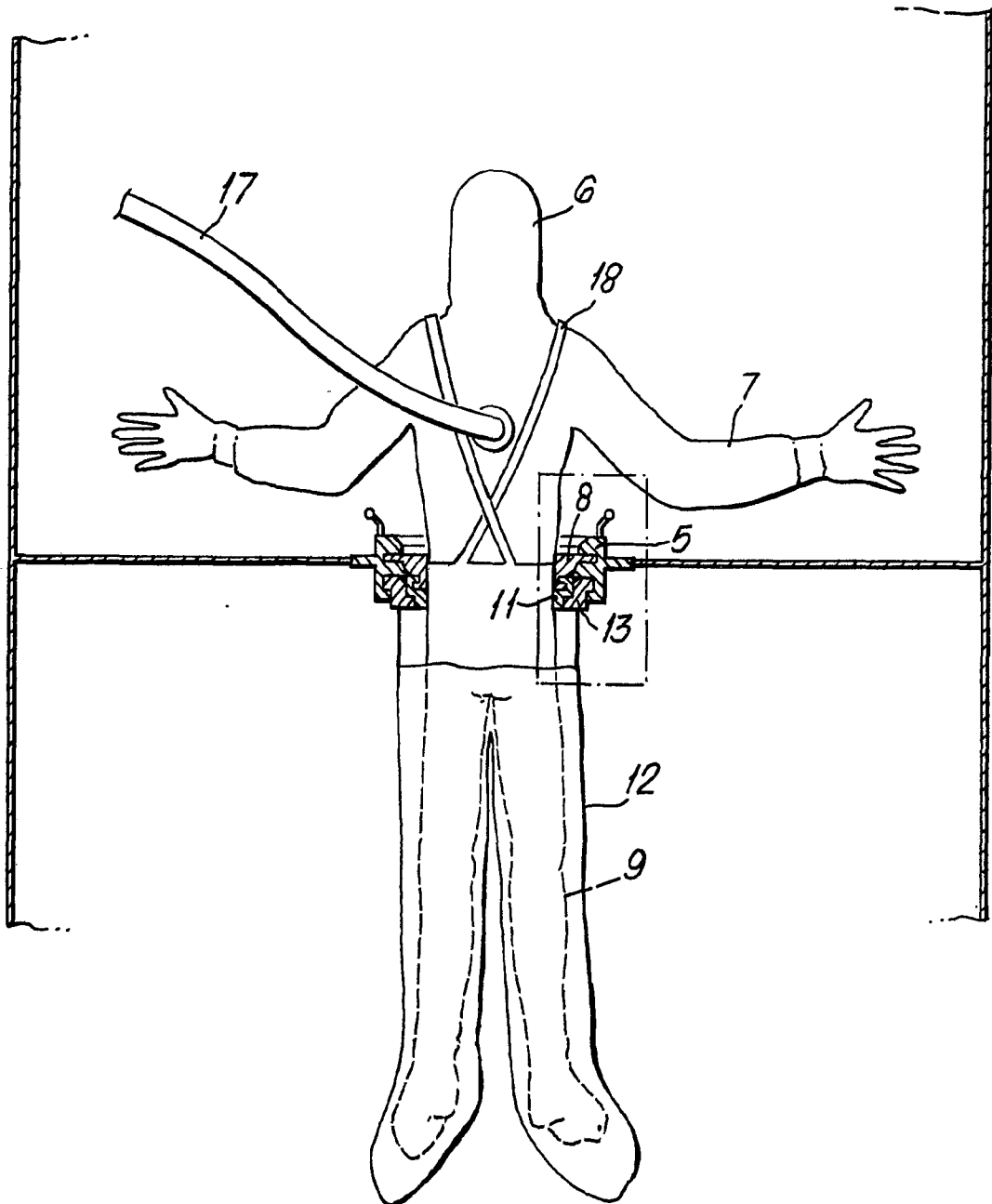


Fig. 1.



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Fig. 2.



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Fig. 3.

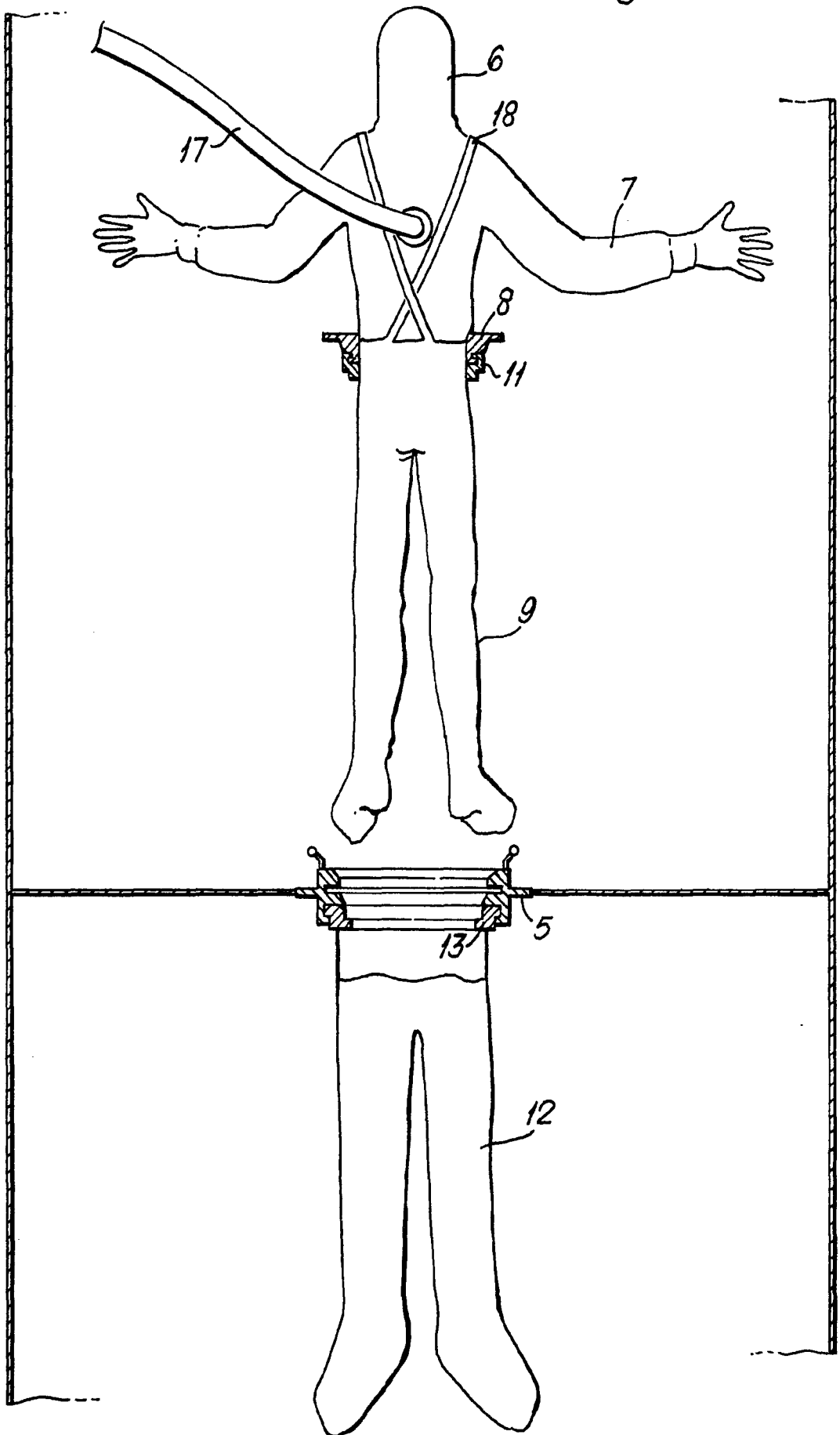


Fig.4.

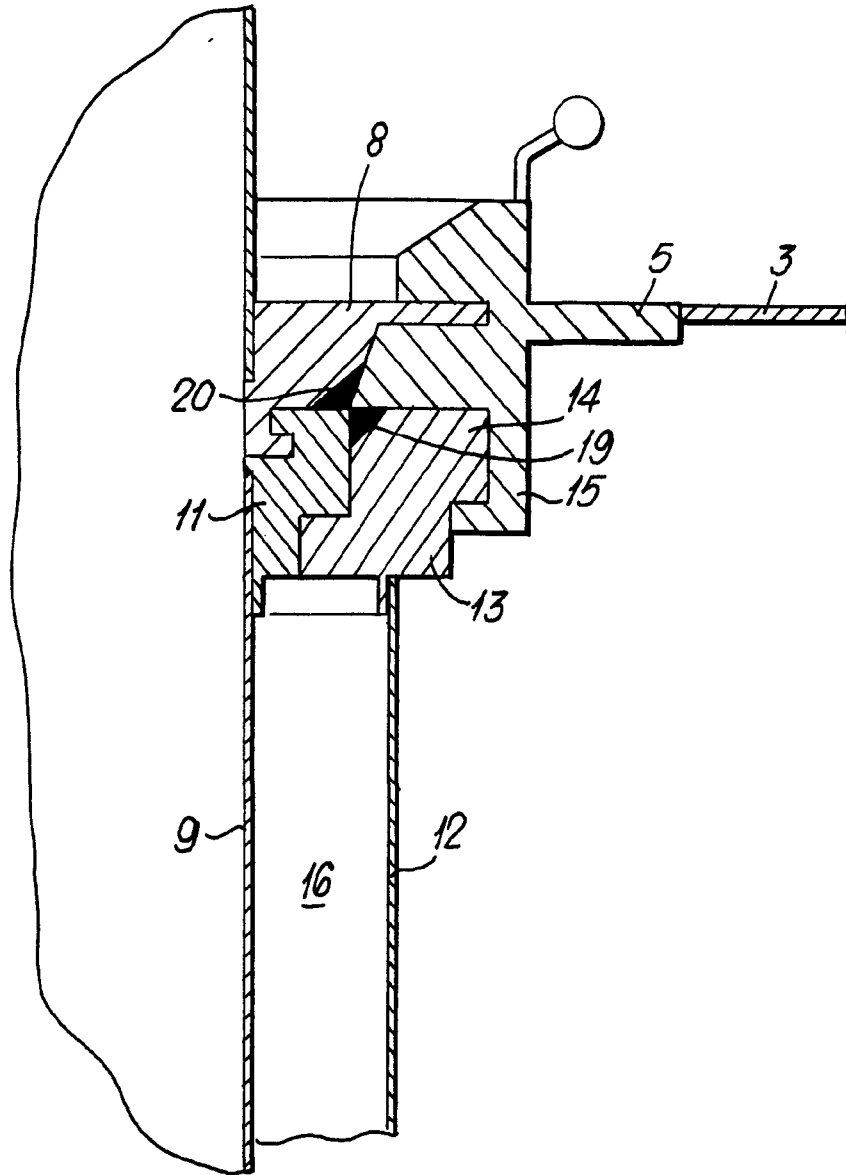


Fig. 5(a).

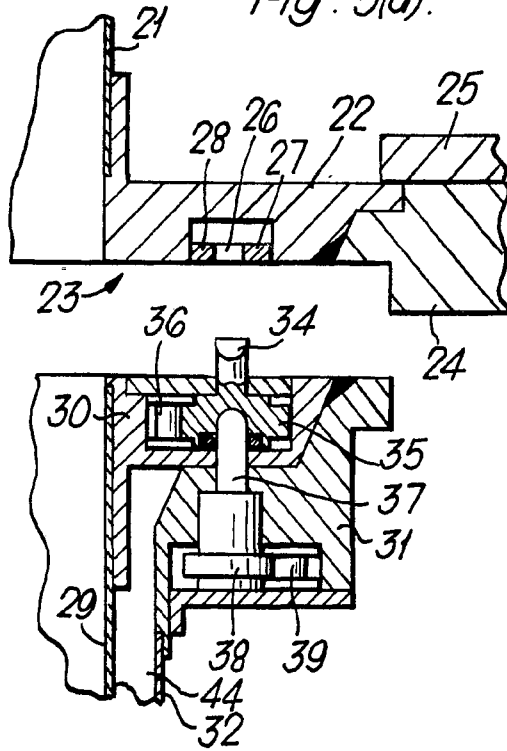


Fig. 5(b).

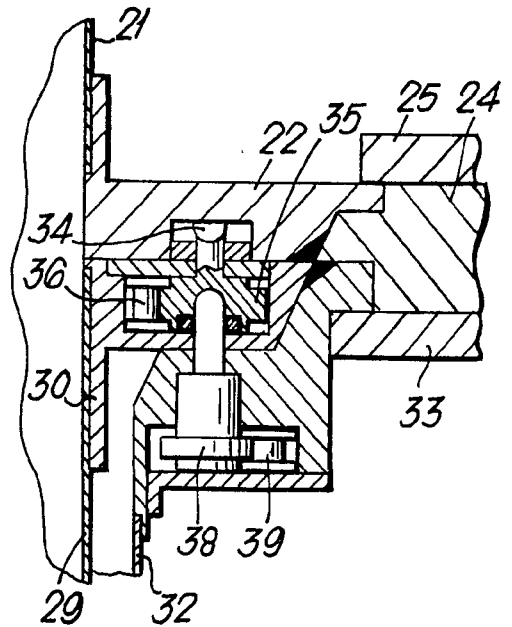


Fig. 5(c)

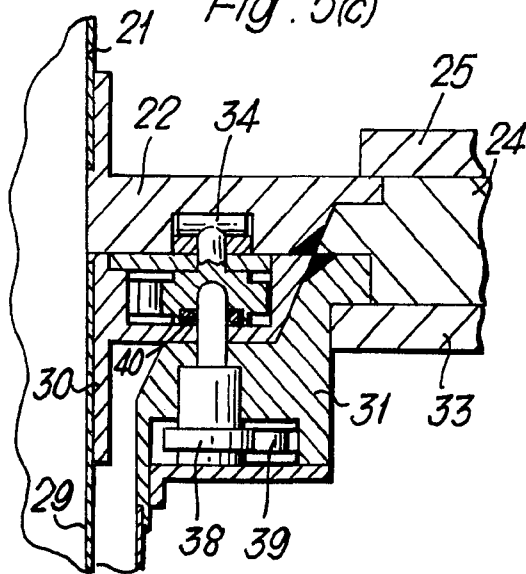
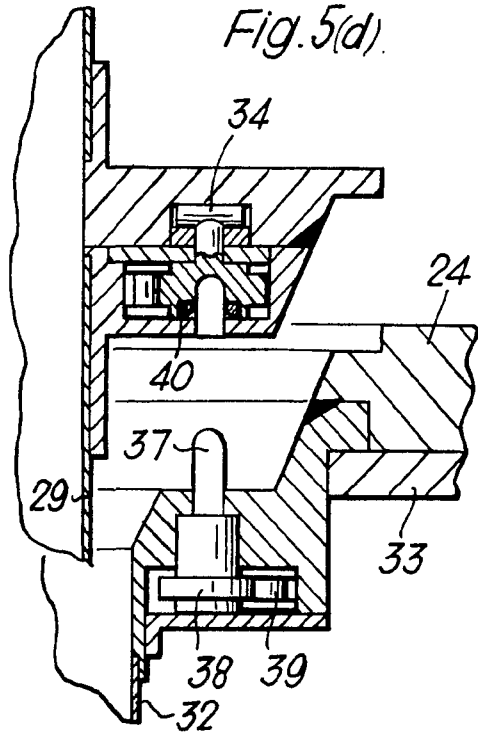
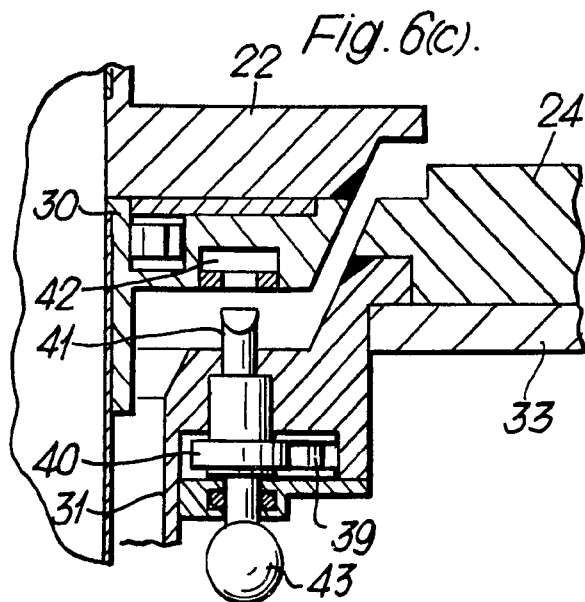
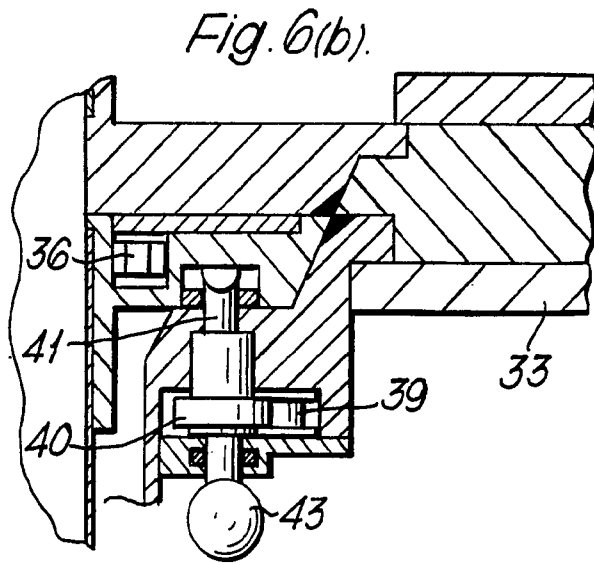
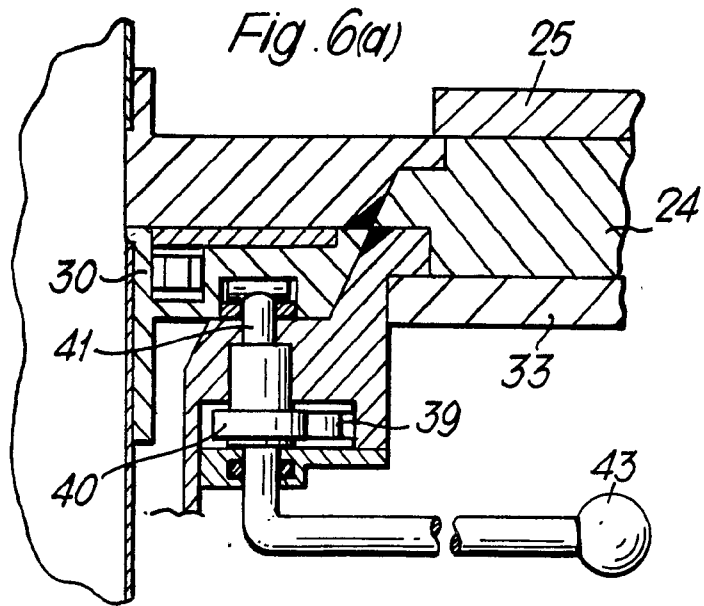


Fig. 5(d).



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SPECIFICATION
Protective clothing

This invention relates to suits for use in contaminated areas, particularly areas
 5 contaminated with radioactivity, in which suits the wearer is completely isolated from the environment of the contaminated area. The interior of the suit is connected to an area outside the contaminated area by an umbilical pipe
 10 through which the wearer is supplied with air.

A known suit for use in contaminated area comprises a one piece suit into which the wearer places his legs, body and arms before placing a helmet over his head to seal the suit. Before use
 15 the one piece suit hangs within the contaminated area and the wearer climbs into it through the neck opening. A double helmet is then placed over the head of the wearer and one part is locked to a collar around the neck opening to seal the suit and
 20 the other part is placed over the opening in the wall of the contaminated area to prevent egress of the atmosphere within the contaminated area during the time when the wearer, wearing his suit and helmet, is inside the contaminated area.
 25 Because the wearer must enter this known suit through the neck opening, the neck opening has to be large enough for the wearer's shoulders to pass through. Thus the collar around the neck opening must be large and can hinder the mobility of the
 30 wearer whilst he is in the contaminated area. Additionally as the helmet is sealed to the suit at substantially neck level any failure of the seal could result in an in leakage close to the mouth and nose of the wearer which increases the risk of
 35 the wearer inhaling any of the contamination which may have leaked into the suit past the neck seal.

It is an object of the present invention to provide a suit for use in contaminated areas which
 40 minimises these disadvantages.

According to the present invention a suit for use in contaminated areas to completely isolate its wearer from the environment within the contaminated area comprises a first part which
 45 includes the head covering and arms of the suit and which is releasably connectible around an aperture in a wall of the contaminated area so that when not in use the first part of the suit remains inside the contaminated area and prevents egress
 50 from the contaminated area, a second part which includes the legs of the suit and which is sealably connectible to the first part of the suit to isolate the wearer from the environment within the contaminated area, and a further part which is
 55 releasably connectible to the second part and which, when connected thereto, totally encloses any surface of the second part which is exposed to the environment of the contaminated area whilst the wearer is within the contaminated area, the
 60 further part also being releasably connectible around said aperture in the wall of the contaminated area to prevent egress of material from the contaminated area whilst the wearer is within the contaminated area.

65 The invention will be illustrated by the following description of two embodiments thereof. The description is given by way of example only and has reference to the accompanying drawings in which:—

70 Figures 1 to 3 show the stages through which the operator must go when entering a contaminated area wearing a first embodiment of a suit according to the invention,

75 Figure 4 is a sectional view on an enlarged scale of the portion of Figure 2 enclosed within the chain dotted rectangle, and Figure 5 (a) to (d) and Figure 6 (a) to (c) show various stages in the operating procedure of a second embodiment.

80 Referring first to Figure 1, a contaminated area 1 is bounded by side walls 2 and a floor 3. An aperture 4 in the floor 3 is surrounded by a ring 5 to which is releasably connected a first part of a suit including the head covering 6 and the arms 7. The first part of the suit has a ring 8 around its
 85 lower opening which interlocks with the ring 5 by means of a bayonet-type fastening. The first part of the suit is stored within the contaminated area 1 when not in use and prevents egress of material from the contaminated area.

90 Figure 1 also shows a second part 9 of the suit which includes the legs 10 of the suit. The upper end of the second part is surrounded by a ring 11 which is fitted with an internal female bayonet fitting which co-operates with a male bayonet
 95 fitting on the ring 8 to connect the first and second parts of the suit. The second part 9 of the suit is surrounded by a further part 12 which may be similar in shape to the second part and has a ring 13 around its upper end. The ring 13 is releasably
 100 connectible to the ring 11 by a bayonet fitting. When the rings 11 and 13 on the second part 9 and the further part 12 are interconnected the further part surrounds the second part and encloses the outer surface of the second part 9
 105 which has been exposed within the contaminated area. The ring 13 on the further part has a male bayonet fitting 14 which co-operates with a female bayonet fitting 15 on the ring 5 to connect the further part around the aperture 4. When the
 110 wearer in the suit is within the contaminated area (as is shown in Figure 3) the further part prevents egress of material from the contaminated area. The interior surface of the further part will however become exposed to the environment of the contaminated area. When the wearer leaves the contaminated area the rings 11, 13 are inter-
 115 engaged and any contamination on this inner surface or on the outer surface of the second part 9 is contained within the space 16 between the second and further parts. A seal 19 between the rings 11 and 13 prevents leakage from the space 16. A similar seal 20 prevents ingress of material into the suit between the rings 8 and 11.

120 When it is necessary for an operator to enter the contaminated area 1 he pulls the combined second and further parts over his legs and climbs into the first part of the suit which is in the position shown in Figure 1 and interlocks the rings
 125 13 and 5. As the rings 13 and 5 interlock, the

rings 8 and 11 interengage (as is shown in Figure 2). Air is supplied to the operator inside the suit through an umbilical pipe 17. After he has disengaged the combined rings 8 and 11 from the combined rings 13 and 5 the operator can enter the contaminated area (as is shown in Figure 3). Straps 18 may be used to support the weight of the combined rings 8 and 11. When the operator leaves the contaminated area the procedure outlined above is reversed.

Referring now to Figures 5 and 6 there is illustrated parts of a suit for use in contaminated areas. The suit is similar to that described above with reference to Figures 1 to 3. A first part 21 of the suit which includes the head covering and arms of the suit (not shown) is connected to a ring 22 which fits around the waist of the wearer. Before the wearer enters the suit the ring 22 is located in an opening 23 in a wall or floor 24 of the contaminated area as is shown in Figure 5(a). The ring 22 is secured in position in the opening by a locking device 25. The ring 22 has a groove 26 of rectangular cross-section in its lower surface which receives two inserts 27, 28 which extend inwardly from the sides of the groove 26 at the open end thereof to give a groove of substantially T-shaped cross section.

A second part 29 of the suit which includes the legs of the suit is connected to a ring 30. A further ring 31 to which is connected a further part 32 of the suit surrounds the second part of the suit. When the wearer is to put on the suit and enter the contaminated area he places his head, arms and the upper part of his body into the first part 21 of the suit and places his legs in the second part 29 of the suit which at this stage is totally enclosed by the further part 32 because the ring 30 and further ring 31 are interlocked. With his legs in the second part the interlocked rings 30, 31 are raised so that the ring 30 contacts the ring 22 and the further ring 31 contacts the wall or floor 24 of the contaminated area. As can be seen from Figure 5 (b) a locking device 33 secures the further ring 31 in contact with the wall or floor 24. As the rings 22, 30 are brought into contact a plurality of T-shaped projections 34 extending upwardly from the ring 30 enter the groove 26. Rotation of the T-shaped projections 34 through 90° causes the projecting upper limbs of the T-shaped projections 34 to enter the enlarged inner portion of the T-shaped groove in the ring 22 to lock the rings 22 and 30 together as is illustrated in Figure 5 (c). Each of the projections 34 which are spaced around the ring 30 is attached to a sprocket 35. The sprockets 35 are interconnected by a chain 36 so that the projections 34 are rotated together to interlock the rings 22 and 30.

Some of the sprockets 35 have on their lower surface a bore to receive a driving pin 37 which extends upwardly from the ring 31. The driving pin 37 may be of square cross section. When the combined rings 22, 30 are released from the wall or floor 24 by releasing the locking device 25 and the combined rings 22, 30 released from the ring 31 as will be described hereinafter the wearer can

enter the contaminated area in the suit. This is illustrated in Figure 5 (d). The bores in the sprockets 35 are then separated from the pins 37 which remain on the ring 31. When the user leaves the contaminated area the bores in the sprockets are replaced on the pins 37. 'O' rings 40 provide a seal around the sprockets 35 and pins 37 to prevent passage of material into or out of the contaminated area.

The pins 37 are supported on sprockets 38 and are interconnected and driven by a chain 39. The chain 39 also drives sprockets 40 on which are supported a plurality of T-shaped projections 41 extending from the ring 31 which engage in a T-shaped socket 42 in the ring 30 to interlock the rings 30 and 31 in a similar manner to that described above for the interlocking of the rings 22 and 30. This is shown in Figures 6 (a), 6 (b) and 6 (c).

The arrangement is such that as the sprockets 40 are driven by the chain 39 to release the ring 30 from the ring 31, the pins 37 rotate the sprockets 35 to cause the chain 36 to rotate the projections 34 to interlock the rings 22 and 30. In the reverse situation as the wearer leaves the contaminated area as the projections 41 are rotated to lock the rings 30 and 31 the projections 34 are rotated to release the rings 22 and 30.

A handle 43 is provided on one of the sprockets 40 to enable the operator to rotate said one of the sprockets and thus via the chain 39 rotate the other sprockets 40 and the sprockets 38. Thus in the position shown in Figures 5 (d) and 6 (c) where the user has entered the contaminated area there will be projecting upwards from the ring 31, which remains secured to the wall or floor 24 by the locking device 33, the pins 37 and the projections 41 in a position that when the wearer leaves the contaminated area the combined rings 22 and 30 can be located on the pins 37 and projections 41.

When the wearer is inside the contaminated area the opening 23 is closed by the further part 32 of the suit. The inside surface of the further part of the suit is therefore exposed to the atmosphere of the contaminated area as is the outside surface of the second part 29 of the suit. When the rings 30 and 31 are interlocked any contamination is contained within the space 44 between the second part 29 and the further part 32.

The rings 22, 30 and 31 of the embodiment described with reference to Figures 5 and 6 do not need to be circular as is the case with the rings 8, 11 and 13 of the embodiment described with reference to Figures 1 to 4 which are interconnected by rotation. The rings 22, 30, 31 may therefore be made in a shape which more closely resembles the human body which will facilitate movement of the wearer inside the contaminated area. Also the rings 22 and 30 cannot become unlocked accidentally whilst the wearer is inside the contaminated area as the chain 36 has to be driven by the sprockets 35 which in turn are driven by the pins 37. In the first

described embodiment the rings 8 and 11 could become unlocked by relative rotation of the rings alone.

CLAIMS

5 1. A suit for use in contaminated areas to completely isolate its wearer from the environment within the contaminated area comprises a first part which includes the head covering and arms of the suit and which is
10 releasably connectible around an aperture in a wall of the contaminated area so that when not in use the first part of the suit remains inside the contaminated area and prevents egress from the contaminated area, a second part which includes
15 the legs of the suit and which is sealably connectible to the first part of the suit to isolate the wearer from the environment within the contaminated area, and a further part which is releasably connectible to the second part and
20 which, when connected thereto, totally encloses any surface of the second part which is exposed to the environment of the contaminated area whilst the wearer is within the contaminated area, the further part also being releasably connectible
25 around said aperture in the wall of the contaminated area to prevent egress of material from the contaminated area whilst the wearer is within the contaminated area.

30 2. A suit as claimed in claim 1 wherein the first part of the suit has a first ring which cooperates with the ring around the aperture in the wall by means of a first bayonet-type fastening to releasably connect the first part around the aperture, the second part of the suit has a second
35 ring which cooperates with the first ring by means of a second bayonet-type fastening to releasably connect the first and second parts of the suit, the further part of the suit has a third ring which cooperates with the second ring by means of a
40 third bayonet-type fastening to releasably connect the second and third rings and which cooperates with the ring around the aperture in the walls by means of a fourth bayonet-type fastening to releasably connect the third ring and the ring
45 around the aperture.

50 3. A suit as claimed in claim 1 wherein the first part of the suit has a fourth ring which is securable in position in the aperture in the wall of the contaminated area by a locking device and the second part of the suit has a fifth ring which is releasably connectible to the fourth ring by first

projections on one of the rings which extend into first openings in the other of the rings when the rings are connected.

55 4. A suit as claimed in claim 3 wherein the first projections on the one ring are substantially T-shaped and the first openings in the other ring are provided by a groove of substantially T-shaped cross-section.

60 5. A suit as claimed in claim 4 wherein the first projections are each connected to a first sprocket and all the first sprockets are rotated by a first continuous chain within the one ring.

65 6. A suit as claimed in any one of claims 3 to 5 wherein the further part has a sixth ring which is releasably connectible to the fifth ring by second projections on one of the fifth or sixth rings which extend into second openings in the other of the fifth or sixth rings and which is securable in
70 position in the aperture in the wall of the contaminated area by a locking member.

75 7. A suit as claimed in claim 6 wherein the second projections on said one of the fifth or sixth rings are substantially T-shaped and the second openings in the other of the fifth or sixth rings is provided by a groove of substantially T-shaped cross-section.

80 8. A suit as claimed in claim 7 wherein the second projections are each connected to a second sprocket and all the second sprockets are rotated by a second continuous chain within the one of the fifth and sixth rings.

85 9. A suit as claimed in claim 5 and claim 7 wherein the first projections extend from the fifth ring and engage with the first groove in the fourth ring, the second projections extend from the sixth ring and engage with the second groove in the fifth ring and at least one of the first sprockets has a bore to receive a driving pin extending from a
90 further sprocket in the sixth ring, said further sprocket being rotated by the second chain, so that when the fourth, fifth and sixth rings are in the correct relative positions movement of the second chain to rotate the second projections, rotates the further sprocket and the rotation is transmitted through the driving pin to said at least one of the first sprockets to cause rotation of the first
95 projections.

100 10. A suit for use in contaminated areas substantially as hereinbefore described with reference either to Figures 1 to 4 or to Figures 5 and 6.