

April 14, 1959

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2,881,758

VENTILATED IMPERMEABLE PROTECTIVE OUTFIT

Filed June 13, 1956

2 Sheets-Sheet 1

Fig. 1.

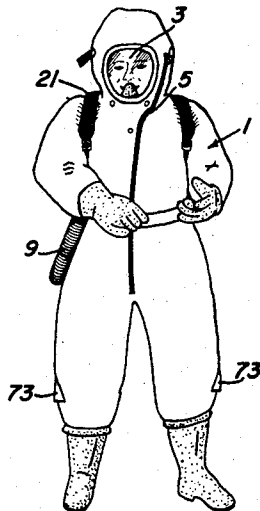


Fig. 3.

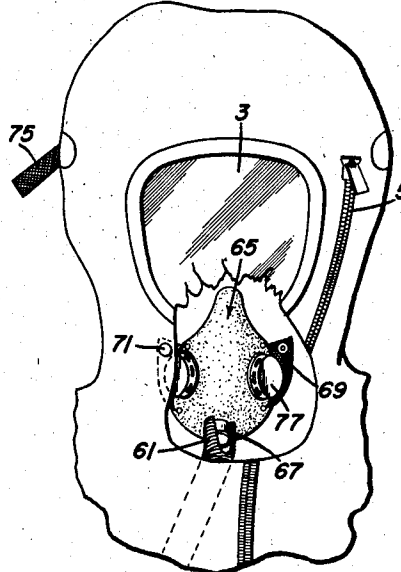


Fig. 2.

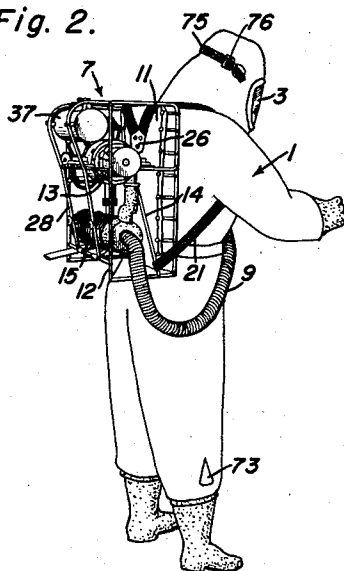
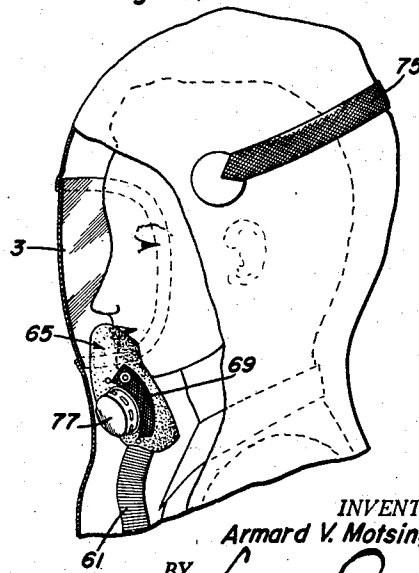


Fig. 4.



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Fig. 5.

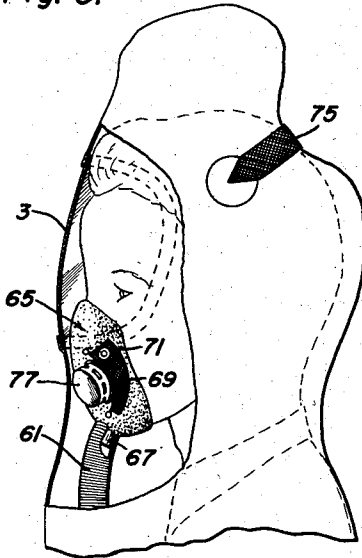


Fig. 6.

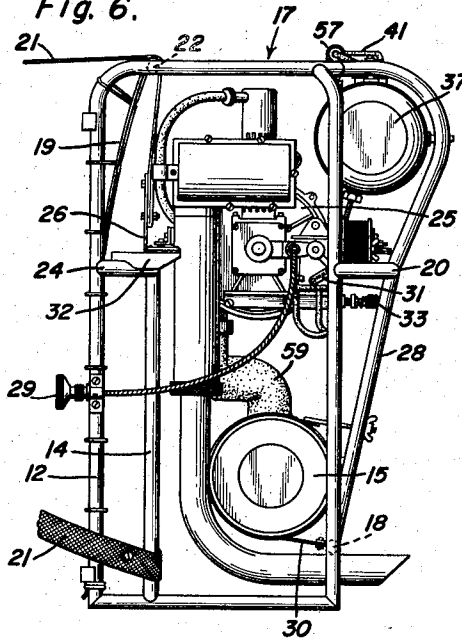


Fig. 7.

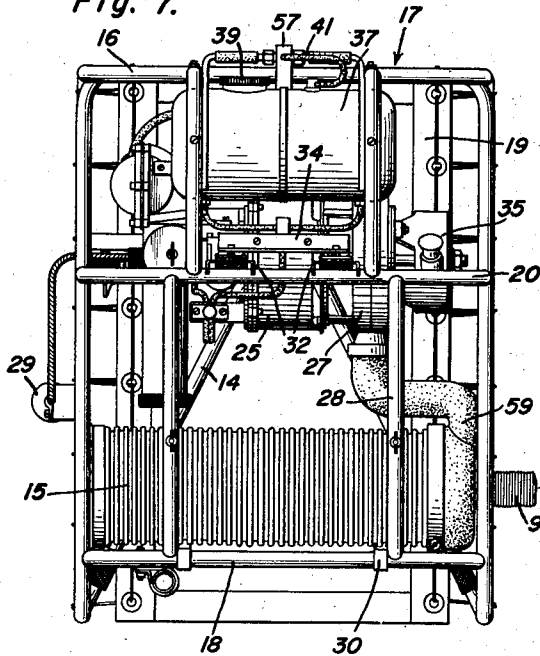


Fig. 8.

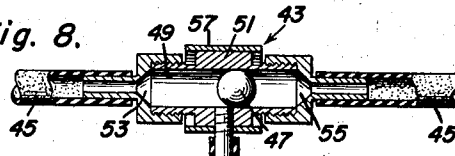


Fig. 9.

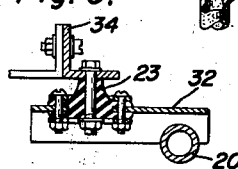


Fig. 11.

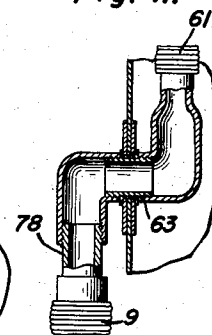
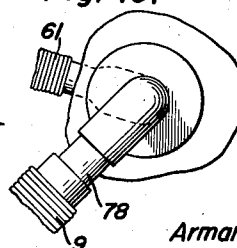


Fig. 10.



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2,881,758

VENTILATED IMPERMEABLE PROTECTIVE OUTFIT

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Application June 13, 1956, Serial No. 591,253

6 Claims. (Cl. 128—144)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to me of any royalty thereon.

This invention relates to a ventilated impermeable outfit for protection of the wearer against toxic and vesicant gases or liquids.

An object of this invention is to provide an impermeable protective outfit in which the purified air is maintained under superatmospheric pressure.

A further object of the invention is to provide an impermeable protective outfit in which air circulates over substantially the entire body.

A further object of the invention is to provide an impermeable protective outfit in which air is normally supplied by a power operated blower, but which can be used without said blower in case of emergency.

A further object of the invention is to provide a vented fuel tank which is suitable for use on a pack frame.

In the drawings; Fig. 1 is a front view of a man wearing the outfit of this invention.

Fig. 2 is a view from the rear of the outfit.

Fig. 3 is a partial front view, broken away to show the nosecup.

Fig. 4 is a partial side view, broken away to show the position of the nosecup in normal operation.

Fig. 5 is a view corresponding to Fig. 4, but showing the position of the nosecup when the outfit is used without operation of the blower.

Fig. 6 is a side view of the pack frame showing the motor, blower and canister.

Fig. 7 is a rear view of the pack frame.

Fig. 8 is a section view of the vent for the fuel tank of the motor.

Fig. 9 is a section through one of the motor mountings.

Fig. 10 is a detail view showing the connection between the air line and the suit.

Fig. 11 is a section through the connection shown in Fig. 10.

Impermeable suits for the protection of individuals against toxic or vesicant agents present serious problems. Previously known suits of this type, because of lack of sufficient ventilation, become almost unbearable in even moderately hot weather. Moreover, it is difficult to make such suits absolutely impervious, particularly to liquids of low surface tension.

I have devised an outfit which overcomes the above difficulties. This outfit comprises an impermeable suit which completely covers the wearer. Fresh air is supplied by a blower powered by a small gasoline motor, which supplies air under superatmospheric pressure to an air purifying canister and thence to the suit. The entire purified air system is thus under superatmospheric pressure and any leakage will be outward rather than inward, preventing the entrance of foreign gases or liquids.

The fresh air enters the suit adjacent the wearer's

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face, while the air outlets are located on the legs. Thus, the wearer breathes fresh air at all times and the entire body is sheathed in a constantly circulating body of air. The outfit can therefore be worn for extended periods of time even in hot weather.

The outfit includes a nosecup through which air is received and which is normally spaced from the face. The outfit is, however, so constructed that in case of power failure the nosecup can be drawn tightly against the face.

The wearer then inhales through the canister and nosecup and exhales into the interior of the suit, producing a slight superatmospheric pressure therein.

In order that the wearer may move freely without danger of spilling gasoline from the fuel tank, I have provided a non-spill vent for the fuel tank.

Referring to the drawings, Figs. 1 and 2 show suit 1 made of gas-impermeable cloth provided with attached boots, gloves and a hood having a substantially rigid plastic window 3. The wearer enters the suit through a rubber sealed zipper 5 in the front of the suit which extends from the crotch up into the hood, where it is curved around the window to a position near the top of the wearer's head. This provides easy entrance to the suit.

Air under superatmospheric pressure enters the suit from a ventilator 7 or other source through hose 9. The ventilator 7 consists of a pack board 11, engine-blower assembly 13 and an air purifying canister 15. This ventilator is made as lightweight as possible for easy transportability by the wearer of the suit.

Referring now to Figs. 6 and 7, the pack board 11 consists of a frame 17 having a fabric back rest 19 and shoulder straps 21 adjusted by conventional slides or buckles thereby allowing the ventilator to be carried on the back of the wearer of the suit. The frame 17 is constructed of tubular members joined to form a substantially rigid unit. These tubular members are preferably made of a lightweight metal e.g. aluminum. The side sections 12, of the frame form a rectangle. Horizontal members 40 span the space between these side sections forming a substantially rigid frame. The lowest members of the rectangular side sections should lie in a substantially horizontal plane so that the ventilator can be stood on the ground when the wearer is starting the engine. For additional strength and stability additional members, as oblique members 14, can be added.

In its preferred form the frame has three horizontal rear members: a top member 16, a low member 18, and an intermediate member 20, and two horizontal front members: a top member 22 and intermediate member 24.

The front top member 22 is displaced inwardly so as not to interfere with the wearer when the unit is worn on the back. The fabric back rest 19 is attached to this top member 22 and to the vertical front members of the side sections. The intermediate members 20 and 24 are U-shaped members, the front member 24 being displaced inwardly of the frame for the same reason as the respective top member. A strap bracket 26 is attached to the front intermediate member 24. Straps 21 are attached to this bracket, pass over the top member 22, then over the wearer's shoulder and are attached at the other end to the oblique supports 14.

Additional tubular members 28 join the lower and intermediate rear horizontal members. Brackets 30 attached to these additional members support the air purifying canister 15.

Brackets 32 are mounted on the intermediate members 20 and 24. L-brackets 34, attached to the engine blower assembly 13, are mounted through rubber shock mounts 23, on the brackets 32 as shown in Fig. 9. The rubber mounts serve to reduce noise and vibration during operation of the engine.

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The engine-blower assembly and the air purifying canister are all mounted within the frame so that said frame further acts as a protective enclosure.

The engine-blower assembly comprises an engine 25 and a blower 27. The engine has a high speed fuel adjustment knob 29, choke 31, gasoline shut off valve 33, recoil starter 35 and gasoline tank 37. The gasoline tank is tightly closed by cap 39.

In the preferred form a two cycle engine is used, as this has a high power output to weight ratio. Also, the blower is connected directly to the engine to further reduce weight. In this way the weight of the unit is kept to a minimum.

Air to replace gasoline used by the engine enters the tank through a tube 41 which connects to a ball valve assembly 43 shown in Fig. 8. The ball valve assembly prevents gasoline from leaking through the vent tubes 45. When the assembly is tilted to either side the ball 47, by action of gravity, rolls in bore 49 of housing 51 and seats itself in one of the counterbores 53 of nozzle 55 thereby always closing the lower vent tube and permitting air to enter through the upper vent tube. The entire assembly is mounted on frame 17 by means of bracket 57.

The large amount of air required for breathing and for the ventilation of the wearer is forced by blower 27 through a rubber boot 59 into the air purifying canister 15. This canister may be of any of the conventional types used on protective masks and collective protectors. The canister contains a filter and absorbents. In the present form, the air from the boot 59 enters the canister through holes at the outer edge at one end. Within the container the air moves radially through the filter and absorbents into a perforated central tube from which it emerges through a nozzle at the entrance end. From this nozzle the air is directed to the suit through hose 9, which has a detachable connector 78 of conventional type, such as friction sleeves or screw type union.

Hose 9 is connected to inlet hose 61 within the suit by means of rubber attachment nozzle 63, as shown in Fig. 11. Inlet hose 61 is connected to a nose cup 65 by means of inlet tube 67 attached to the nose cup. The nose cup 65 has integral rubberized triangular pieces 69, which are attached to the suit by attachment buttons or fasteners 71, located near the lower portion of plastic window 3, thereby holding the nose cup in proper position in front of the nose and mouth.

In the normal position shown in Fig. 4 the nose cup is held away from the face and the air is directed towards the mouth and nose of the wearer. Part of the air is breathed and the excess not breathed is forced down through the suit with exhaled air by air entering the suit under superatmospheric pressure. This excess air removes perspiration and cools the body while passing through the suit and emerges from the suit through outlet valves located just above the boots in pockets 73 on the exterior of the suit, which are open at the bottom. These valves should be low-resistance valves e.g. those shown in Patent No. 2,369,170 dated February 13, 1945. The purpose of the pockets is to hold uncontaminated air, which would be harmless in the event of leakage of air back into the suit through the outlet valves in such pockets.

The nose cup 65 is provided for emergency use in case of failure of the air supply. In such a case the nose cup is pushed against the face and is held in position by exterior strap 75 as shown in Fig. 5. This strap is located at the back of the hood and is attached to the hood by any suitable means at a position near the upper portion of plastic window 3, as shown in Figs. 4 and 5, and is adjusted in length by buckle 76. When tightened, this strap exerts tension on the nose cup through the attachment buttons 71, the sides of the hood and the plastic window 3. Because the position of the attachment of the strap to the hood and the nose cup attachment but-

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tons is near the substantially rigid plastic window 3, the tension exerted by the strap is sufficient to retain the nose cup securely against the face of the wearer. An inlet valve of any conventional type, e.g. a flat rubber disk, is mounted in a suitable location to prevent exhalation of air back through the hose 61 when the nose cup is against the face. The inlet valves may be in any of the locations in which such valves are commonly mounted in gas masks, e.g. at the inlet end of tube 67 or in canister 15. The nose cup has conventional outlet valves 77 mounted in the rubber piece 69, through which valve air is expelled into the suit when the nose cup is against the face. Air does not pass through these outlet valves when the nose cup is in its normal position away from the face. In such emergency position the wearer inhales through the canister and nose cup and exhales into the interior of the suit through outlet valves 77. This keeps the interior of the suit under slight super-atmospheric pressure. The air finally escapes through the outlet valve of the suit.

Having thus described what I believe to be the preferred embodiment of my invention it will be understood that various modifications may be resorted to within the scope and spirit of the appended claims.

I claim:

1. An impermeable ventilated protective outfit comprising an impermeable suit covering substantially the entire body of a wearer and comprising a hood enclosing the head of the wearer, an air purifying canister, a blower constructed and arranged to supply air under super-atmospheric pressure to said canister, a conduit connected to said canister and said suit and constructed and arranged to conduct purified air from said canister to said suit, said conduit having an inner end terminating adjacent the face of the wearer, a nose cup mounted within said hood on the inner end of said conduit in such a manner as to receive air from said conduit, said nose cup comprising at least one outlet valve adapted to permit air to flow through from said nose cup into said suit but to prevent reverse flow, means on said suit for adjusting the position of said nose cup from a position spaced from the face of the wearer to one in which it is pressed tightly against the face of said wearer, outlet valves in the lower portion of said suit, power means for operating said blower, and means for supporting said canister, blower, and power means on the wearer.

2. An impermeable ventilated protective outfit as defined in claim 1 in which said power means comprises a gasoline driven engine, a tank to hold the fuel supply for said engine, and means to vent said tank to the atmosphere, said vent means comprising means to prevent leakage of fuel from said tank when said tank is tilted.

3. An impermeable ventilated protective outfit as defined in claim 2 in which said vent means comprises a housing, a bore in said housing, a nozzle attached to said housing and open to the atmosphere, a conduit from said tank to said bore in said housing, a movable ball within said housing so adapted as to roll in said bore against said nozzle when said tank and housing are tilted thereby preventing fuel from leaking through said nozzle.

4. An impermeable ventilated protective outfit as defined in claim 3 in which said vent means further comprises a second nozzle attached to said housing and open to the atmosphere, said second nozzle remaining open to the atmosphere when said ball rolls against said first mentioned nozzle thereby venting said tank to the atmosphere through said second nozzle.

5. An impermeable ventilated protective outfit as defined in claim 1 in which said means to support said canister, blower, and power means on said wearer comprises a frame, a back rest attached to said frame and adapted to lie against the back of said wearer; adjustable straps attached to said frame and adapted to encircle said wearer so the said frame can be securely supported on

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the back of said wearer and means attached to said frame for supporting said canister, blower and power means within said frame, said frame comprising a plurality of tubular members so attached as to form a substantially rigid unit having substantially rectangular parallel side sections each having a base member, said base members lying in a substantially horizontal plane so that said unit can be stood in an upright position when not supported by the wearer.

6. An impermeable ventilated protective outfit as defined in claim 1 wherein said hood comprises a substantially rigid plastic window, said nose cup being attached to said hood adjacent said plastic window, and said means for adjusting the position of said nose cup comprising an adjustable strap attached to said hood adjacent said plastic window, whereby said strap can exert tension through said hood and said plastic window and hold said nose cup securely against the face of the wearer.

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