Oct. 24, 1933. B. M. THOMPSON 1,931,562

IMPERMEABLE SUIT FOR CHEMICAL WARFARE

Filed Oct. 21, 1931

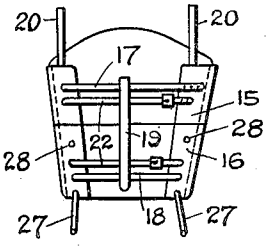


Fig. 2.

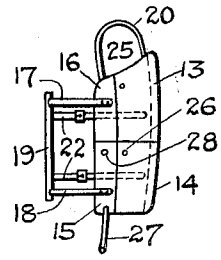


Fig. 3.

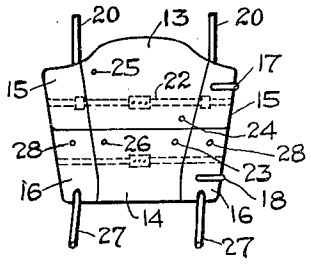


Fig. 4.

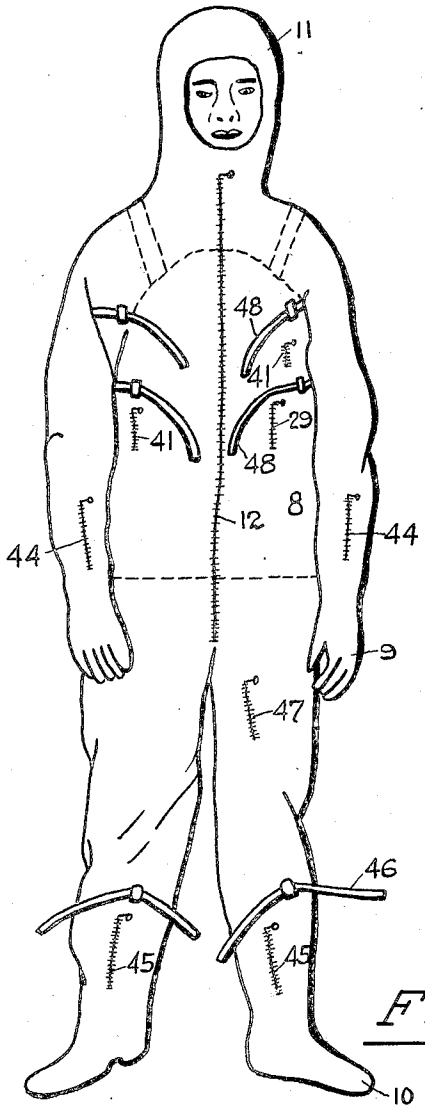


Fig. 1.

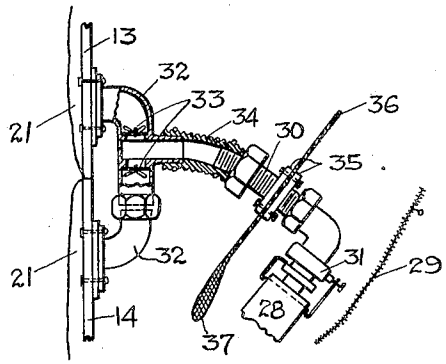


Fig. 5.

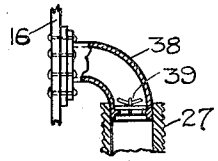


Fig. 6.

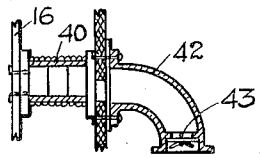


Fig. 7.

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1,931,562

IMPERMEABLE SUIT FOR CHEMICAL WARFARE

Beriah M. Thompson, United States Navy

Application October 21, 1931. Serial No. 570,126

6 Claims. (Cl. 128—144)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention relates to a suit that is impermeable to the gases used in chemical warfare, and more especially to one that may be worn continuously for long periods without discomfort.

It is the object of my invention to provide means for removing from the interior of a suit of the kind specified the air that has become foul and warm through contact with the body of the wearer and replacing it with fresh air that has been chemically treated to neutralize the noxious gases present in the atmosphere in that locality.

In the drawing:

Fig. 1 is a representation of a man wearing a suit made according to my invention;

Figs. 2, 3 and 4 are respectively back, side and front views of the bellows by means of which the circulation of air in the suit is forced;

Fig. 5 is a schematic view of the connections between the bellows and a gas mask canister;

Fig. 6 is a diagrammatic view of the valve through which the air from inside the suit is taken into the bellows;

Fig. 7 is a like view of the valve through which the air from within the suit is discharged into the atmosphere.

Heretofore the suits used to protect men against the gases used in chemical warfare have not been effective against liquid mustard gas due to the necessity of having the material of such suits sufficiently porous to permit the escape of the body exhalations. The fabric of a suit ventilated in the manner herein disclosed may be made absolutely tight, so that even if the wearer is sprinkled with liquid mustard gas or the like, he will be unharmed thereby. Cloth such as was used in the officer's blouse, old type, when given a tight weave to make it air-tight, and treated to withstand mustard gas and Lewisite for long periods, is very satisfactory for this purpose.

The suit 8 is in the form of a one piece garment, with attached hands 9, feet 10 and head 11. Down the front, from Adam's apple to crotch, is a separable seam-fastener 12, gas-tight when closed. The seam 12 is not continued higher because the gas mask cannot be properly fitted on if a seam extends beyond that point, the mask covering the face and closing the opening left in the suit therefor. In previous suits of this kind a flap seam extends from the top of the tightly closable seam to the face opening, but as it cannot be made gas-tight, it is not used by me. A suit made according to my invention is somewhat more difficult to put on than when it can be opened to the face aperture, but this difficulty can be largely overcome by making the suit oversize—a factor to be desired for ventilation purposes anyway.

The ventilating bellows or breather utilizes the natural movement of the torso due to the action of the lungs and diaphragm. When a person is breathing at an ordinary rate, most of such motion occurs in the region of the diaphragm, just above the stomach and below the chest, the motion extending out to the sides of the torso, but during heavier breathing due to exertion, the said movements extend to the chest also.

The breather comprises a light but rigid frame, preferably made of fibre board, having front sections 13 and 14, and sections 15 and 16 on each side. Transverse strips 17 and 18 of stiffening material, such as the fibre board mentioned or light metal, extend across the back of the device and are attached to a back stiffener 19. Straps 20 are secured to the frame and pass over the shoulders to support the breather. A light, flexible diaphragm 21 of silk or like material is secured at its edges to each section of the frame, or the diaphragm may be in the form of a bag whereof one side is attached to the entire inner surface of the frame section. Adjustable elastic straps 22 are attached to the diaphragms and fastened around the body of the wearer with a snug fit so that contraction of the torso during exhalation of the breath will retract the diaphragm somewhat away from the frame, setting up a partial vacuum and drawing air into the space between the diaphragm and the frame. Upon expansion of the torso by inhalation, the air thus drawn into the apparatus is expelled.

Air from the exterior is taken by the diaphragms on the front sections through apertures 23 and 24 which are connected to a gas mask canister, as hereinafter explained, this air being discharged into the suit through apertures 25 and 26 which are connected to one-way valves so that air may not be drawn in therethrough. At the sides, one diaphragm is common to the two sections 15 and 16, air being drawn thereinto through tubes 27 that extend down into the legs of the suit, and being discharged to the atmosphere through apertures 28 that are connected to suitable valves. A better circulation in the legs is effected by having the air withdrawn through tubes 27, as the air released into the suit through apertures 25 and 26 will move down to replace that which is removed to the atmosphere.

A gas mask canister 28 containing gas-neutralizing chemicals is carried in the pocket closed by fastener 29. A pipe 30, including a shut-off valve 31, connects canister 28 to branch pipes

32 that lead to apertures 23 and 24, there being flapper check valves 33 in the pipes 32 to permit air to be taken into the breather but prevent movement thereof in the opposite direction. The connection between the breather and the canister is made flexible by the insertion of a length of hose 34, preferably circumferentially corrugated to prevent collapse, as is well known in the construction of gas masks. Flanges 35 screwed on pipe 30 are firmly clamped against the impermeable fabric 36 inside the canister pocket to prevent access of gas around the pipe, a pad 37 fastened to the fabric being interposed between canister 28 and the breather frame to prevent wearing through the fabric between them.

Tubes 27 are connected to fittings 38 that are secured to frame sections 16 and carry one-way valves 39 which permit air to be drawn from the interior of the suit by the diaphragm but prevent the return of air to the suit. Apertures 28 are in communication with tubes 40 that are secured to the fabric of the suit around holes in pockets 41, there being a fitting 42 carrying a one-way valve 43 in each of the pockets 41 to permit expulsion of air from the side diaphragms of the breather but prevent access of gas into the suit therethrough, the fabric being clamped between tube 40 and fitting 42 to make the suit impervious to gas at that place. All the one-way valves should be made of rubber except the outlet valves 43, which are preferably of aluminum since rubber is somewhat affected by mustard gas.

Openings with gas-tight closures are provided at 44 for the hands and at 45 for the feet, so that those members may be free of the suit when not in gas. Tie-ties 46 are provided for securing the feet 10 of the suit against the backs of the legs thereof when the wearer has his feet out of them while wearing the suit. The pocket at 47 is for reception of a body waste remover, as described in my copending application Serial Number 573,159, filed November 5, 1931, which has matured into Patent No. 1,898,104, issued February 21, 1933. Tie-ties 48 are provided on the outside of the suit to permit drawing the breather more tightly against the body in case it is found, after the suit is on, that the breather is held too loosely to function properly.

The suit is put on by opening seam 12 all the way down, inserting the feet, then the left arm and head, and last the right arm, the oversize of the garment permitting this to be done. Shoes worn with this suit need not be impermeable to gas, as they are worn over the feet 10.

It will be understood that the above description and accompanying drawing comprehend only the general and preferred embodiment of my invention and that various changes in construction, proportion and arrangement of parts may be made within the scope of the appended claims and without sacrificing any of the advantages of my invention.

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 of any royalties thereon.

I claim:

1. Means for protection against chemicals, comprising a garment impervious to such chemicals adapted to envelop all but part of the face of a wearer, a gas-tight seam extending from the crotch thereof almost to the face opening therein, a plurality of pockets in the front thereof, each of said pockets having a gas-tight closure, and means including a frame that is substantially non-resilient and a flexible portion adapted to contact the torso of a wearer coacting with said frame to form an enclosed space operable solely by respiratory movements of the body of a wearer connected with said pockets to ventilate the interior of said garment.

2. Means for protection against chemicals, comprising a garment adapted to substantially completely envelop a wearer, and means for ventilating the interior of said garment including a substantially rigid frame having front and side sections adapted to be supported inside said garment on the torso of said wearer, two light diaphragms on the front of said frame and one on each side thereof forming enclosed spaces adjacent said frame, adjustable means for connecting said diaphragms to the body of the wearer so that respiratory movements of the torso actuate said diaphragms to draw air into and expel it from said spaces, a pocket in said garment, in said pocket a canister containing substances to neutralize harmful gases, a pipe connected to said canister through a shut-off valve, a branch from said pipe communicating with each of the said enclosed spaces at the front of the frame, a one-way valve in each of said branches to prevent passage of air from said spaces to said canister, valve controlled apertures to permit air to pass from said front enclosed spaces to the inside of said garment, a tube extending downwardly into each leg of said garment and communicating with an enclosed space at the side of said frame, a valve in each of said tubes to permit air to move into said spaces but not out therefrom, means connecting each of said side enclosed spaces with the exterior of said garment, and a one-way valve in each of said means to prevent passage of air from the exterior into the respective space but permit egress of air therefrom.

3. Means for ventilating the interior of an impermeable garment, comprising a substantially rigid frame adapted to be supported on the torso of a wearer, a flexible diaphragm secured to the front of said frame and connectible to the body of the wearer to be moved by the respiratory movements thereof to draw air into and expel it from a space whereof said diaphragm forms one wall, means to conduct air to said space, a one-way valve in said means, a container in which is material to neutralize harmful gases disposed in the path of air being drawn into said space, means controlled by a one-way valve to permit egress of air from said space, a second diaphragm operable by the said respiratory movements and in part defining a second space, one-way control means to admit air from the interior of said garment into said second space, and one-way control means to permit expulsion of air from said second space to the exterior of said garment.

4. In combination, an impermeable garment, means to ventilate the interior thereof comprising a bellows-like device actuable by respiratory movements of the wearer thereof to draw air into and expel it from said garment, said device including a frame that is substantially non-resilient and a flexible portion adapted to contact the torso of a wearer coacting with said frame to form an enclosed space in communication with the interior of said garment to cause circulation of air therein and means to neutralize harmful gases in air so drawn in.

5. In combination, an impermeable garment, and means to ventilate the interior thereof comprising a bellows-like device actuable by the respiratory movements of the wearer thereof, said device including a frame that is substantially non-resilient and a flexible portion adapted to contact the torso of a wearer coacting with said frame to form an enclosed space in communication with the interior of said garment to draw air into and expel it from said garment.

6. Means for ventilating the interior of an impermeable garment, comprising a bellows-like device actuable by the respiratory movements of a wearer thereof, said device including a frame that is substantially non-resilient and a flexible portion adapted to contact the torso of a wearer coacting with said frame to form an enclosed space in communication with the interior of said garment to draw air into and expel it from the interior of such garment.

BERIAH M. THOMPSON.