March 9, 1954 W. E. GROSS 2,671,528

AIR PURIFIER

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FIG. 1.

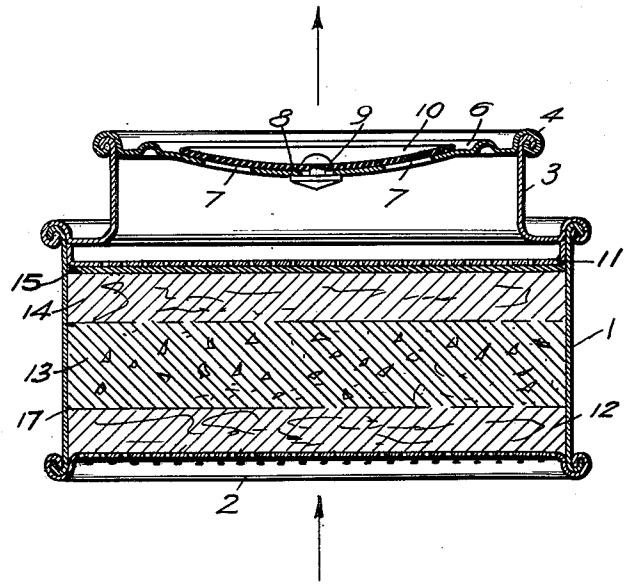
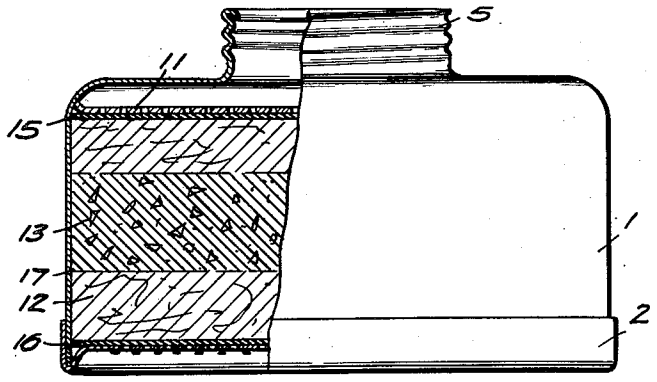


FIG. 2.



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AIR PURIFIER

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

This invention relates to apparatus for filtering and purifying air containing noxious gases, vapors and/or smokes; more particularly, it relates to a canister used in connection with gas masks and the like.

In order to render contaminated air fit for breathing, it has been the practice to use a gas mask with a connected canister, whereby all inhaled air must first pass through the canister to be filtered and purified therein.

Fundamental requirements of air-purifying canisters are: inexpensive manufacture, limited use of critical materials, light weight, compactness, and efficiency in air purification.

Although many varieties of air purifiers are known to have been developed, there has been need for improvements with which this invention is concerned.

One object of tihs invention is to simplify and improve the construction of gas mask canisters so that they more satisfactorily meet the fundamental requirements.

Among more specific objects, this invention provides an air purifier improved in the following respects: (*a*) by minimized internal structure, particularly with avoidance of parts attached inside the canister; (*b*) prevention of channeling by use of a resilient medium that also functions as a smoke filter; and (*c*) protection of the air purifier filling from water, moisture, and oil aerosols. These and other objects will be apparent from the following description and accompanying drawing.

In the drawings are shown two modifications of canisters embodying features of the invention. The same reference characters refer to like parts.

Figure 1 diagrammatically illustrates a side elevational cross-section view of one canister modification.

Figure 2 illustrates an elevational side view of another canister modification partly in section.

Referring particularly to the drawing, the canister comprises an outer gas-tight and waterproof casing or body 1 which may be made of sheet metal. The body may be cylindrical or box shaped.

Referring to Figure 1, the body 1 is crimped or double-seamed in tight engagement with cover 2 that is perforated and preferably dished inwardly. As shown in Figure 2, the inlet cover

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may be detachably fitted to the body by screwing, bead and slot engagement, or a friction fit so that the canister filling may be readily removed and renewed.

At the outlet end in the upper part of the canister, shown in Figure 1, the body is tightly engaged by double seaming to a valve holder support 3 having an outwardly formed bead or rim 4 to facilitate secure attachment to a facepiece. Alternatively, as shown in Figure 2, the canister body may be drawn to a narrowed neck 5 threaded for securing into an adapter, a corrugated hose, or valve holder on a facepiece.

Valve seat 6 which is securely engaged to the support 3 has air outlet ports 7 and a central aperture 8 through which is passed a connecting button or fastener 9 that holds the check valve disc 10. The check valve disc 10 made of rubber or any similar flexible plastic material is normally seated so that it closes the ports 7 except when air is being inhaled through the canister.

A perforated retainer 11, preferably dished inwardly, is disposed above the filling in the canisters and rests against the shoulder at the upper part of the body. Advantageously, this retainer does not have to be rigidly secured or fastened inside the canister. It may have a snug fit or a loose fit so that it more or less floats on the filling and can be readily removed or placed back into the canister on assembly or in making repairs.

Between the perforated inlet cover at the bottom and the perforated retainer 11 are placed in the order, as shown in Figure 1, a layer or pad 12 of highly resilient rock-wool; a decontaminating layer 13 comprising well known chemical agents including charcoal, which physically adsorbs, chemical absorbs, or neutralizes noxious gases; and a layer or pad 14 of fairly resilient rock-wool.

A feature of this invention is that a resilient fibrous inorganic material, particularly one like rock-wool, which is not affected by water, keeps the granular air-purifying material tightly packed, thus serving to eliminate the need of a spring or other means for preventing loosening and channeling.

When the rock-wool is highly resilient, it usually has a fair smoke filtering action; and when it is moderately resilient, it usually has a very good smoke filtering action, although it does not have sufficient resiliency to maintain granules of the chemical filling in a compact condition during a rough usage test. Tests

showed that the canister could stand a rough usage test if a pad of highly resilient rock-wool is placed on one side of the chemical filling and one pad of the less resilient rock-wool is placed on the other side, thus sandwiching the chemical filling. This combination resulted in better smoke protection than when both pads were of the highly resilient rock-wool. As a chemical filling in layer 13 there may be used activated charcoal, impregnated charcoal, such as whetlerite, soda-lime, Hopcalite and various other substances alone or in combinations for removing gaseous contaminants by chemical and/or physical action. For simplicity, these chemical agents are herein referred to as absorbents. The chemical filling may be made up of one or more layers.

As illustrated in Figure 2, waterproof filter paper may be placed on both sides of the chemical filling, i. e., for example, at 15 adjacent the retainer 11 above the resilient filter medium 14 and at 16 or 17 so that the chemical filling is protected on both sides from water. On the outlet side the chemical filling is protected from saliva and on the inlet side it is protected from entrance of rain, or the entrance of water on the accidental immersion or upon immersion when the user is forced to ford a stream, the rock-wool itself giving substantial protection against water.

An air-purifying canister designed as shown in Figure 1 may be attached directly to a facepiece. It may be carried in an approximately vertical position but will operate equally as well in a horizontal or any other position.

Air rendered noxious by the gas or smoke enters the canister through the perforated lower cover 2, passes through the highly resilient rock-wool smoke filter 12, then through the chemical filtering absorbent 13, through the resilient smoke filter 14, and up through the outlet or check valve ports 7 into a hose, adapter, or suitable facepiece.

The simplified canister requires a minimum use of machinery, critical material such as steel, and skilled labor for its production. It readily lends itself to manufacture from non-metallic materials, such as plastics; and even if made from metal, a relatively small amount of metal is used. By virtue of the tough resilient nature of the filtering medium made of a material such as rock-wool, the canister does not require the use of separators between the filtering medium and the chemical filling absorbent layers, as contrasted with conventional canisters that employ wire screen, perforated plates, etc. as separators; thus, the amount of metal used and weight of the canister are substantially reduced. The cushioning effect of the resilient filtering medium permits chemical absorbents of low hardness value and high efficiency to be used without fining during rough usage, as contrasted with conventional canisters that require a fairly hard absorbent to prevent fining or grinding during rough handling. The canister can be readily assembled, repaired and renewed by unskilled personnel.

Due to the resilient nature of the rock-wool, filter pads may be cut over-size so that when installed in the canister they expand against the sides and prevent contaminated air from channeling around the edges, as contrasted with conventional canisters that require sealing of filter materials at the edges inside the canister in order to prevent channeling. Also, by use of the resilient filter medium, the air flow is evenly distributed over the cross-sectional area of the absorbent layer and thus dispenses with the use of baffles and other internal structure generally required in conventional canisters.

Complete engineering tests on canisters constructed in accordance with the present invention prove the canister to be satisfactory in every way. The chemical filling was placed in the canisters between the resilient filter medium pads without having to use expensive vibrating presses or similar devices for strongly compacting the chemical absorbent in order to prevent deformation and channeling during rough usage. The rock-wool filter was found to be unaffected by exposure to oil vapor or smoke. Canisters were actually submerged in water for a substantial period without subsequent damage. When subject to rough usage, no appreciable effect was made on their performance.

With the simplified design, the canisters may be adapted for use with civilian masks, training masks, various service masks and with industrial masks or other protective respiratory devices in large quantities at low costs.

It is to be understood that the invention is not limited to details of construction herein shown by way of illustration, since variations will readily occur to those skilled in the art without departing from the spirit of the invention or exceeding the scope of the appended claims.

I claim:

1. A gas mask canister cylinder that includes in combination a pair of oversize diameter filter pads packed into said canister cylinder and held in lateral compression thereby, said pads being composed of mineral wool characterized by its resilience; a decontaminating layer held in compression between said pads solely by said resilience; and waterproof filter means arranged to arrest the entrance of moisture at each end of said canister.

2. An axial flow air purifier comprising a container; a filler; a perforated fixed inlet plate; a perforated floating outlet plate; a valve; means maintaining said valve in sealed communication with said outlet plate; waterproof filter means at each end of said container arranged to arrest the entrance of moisture into said filler; said filler consisting of a pair of mineral wool filter pads characterized by their resilience and held under lateral compression in said container; and a layer of decontaminating material held between said pads in compression exerted solely by said resilience.

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