Jan. 27, 1953 W. P. YANT 2,626,678

SEALED AIR-PURIFYING CANISTER

Filed Aug. 11, 1951 2 SHEETS—SHEET 1

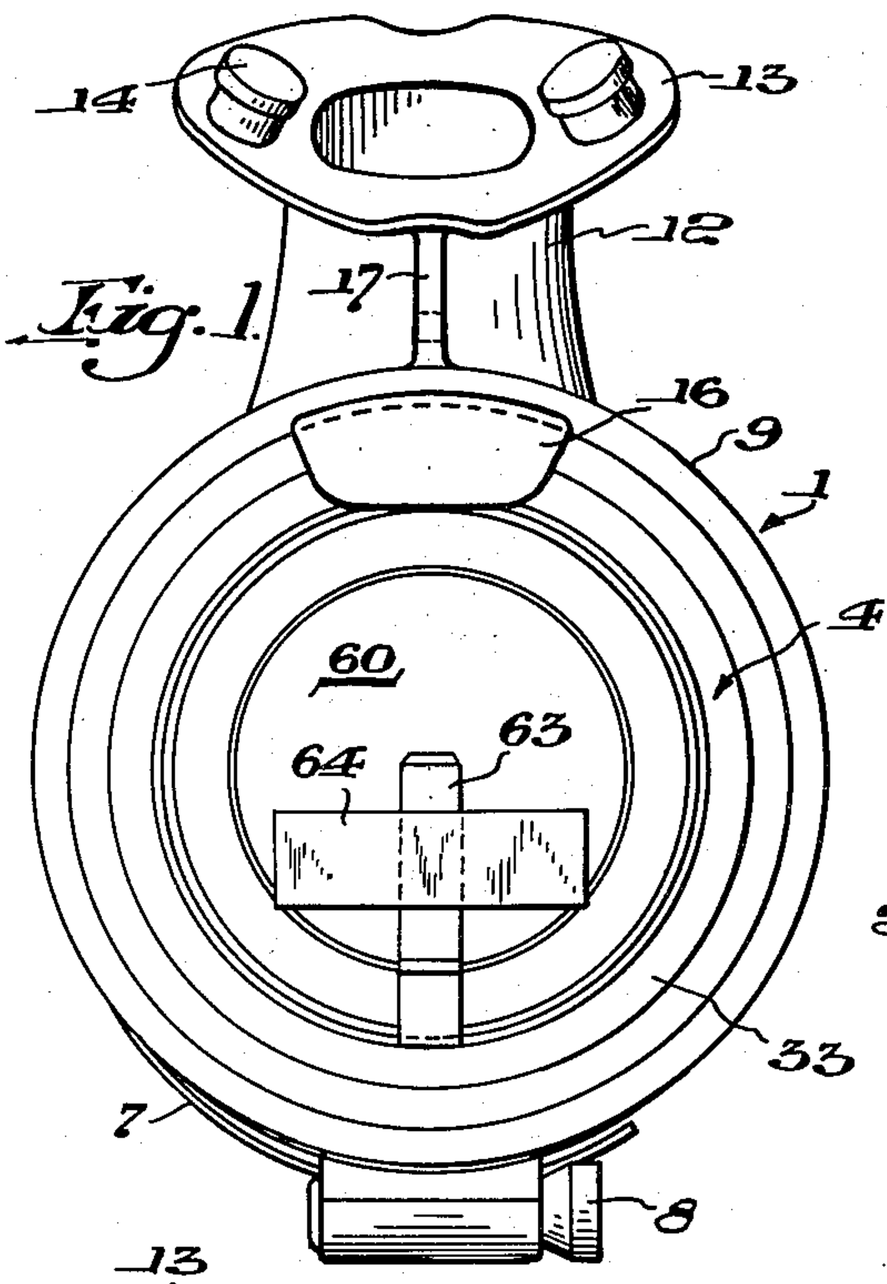

Fig. 1.

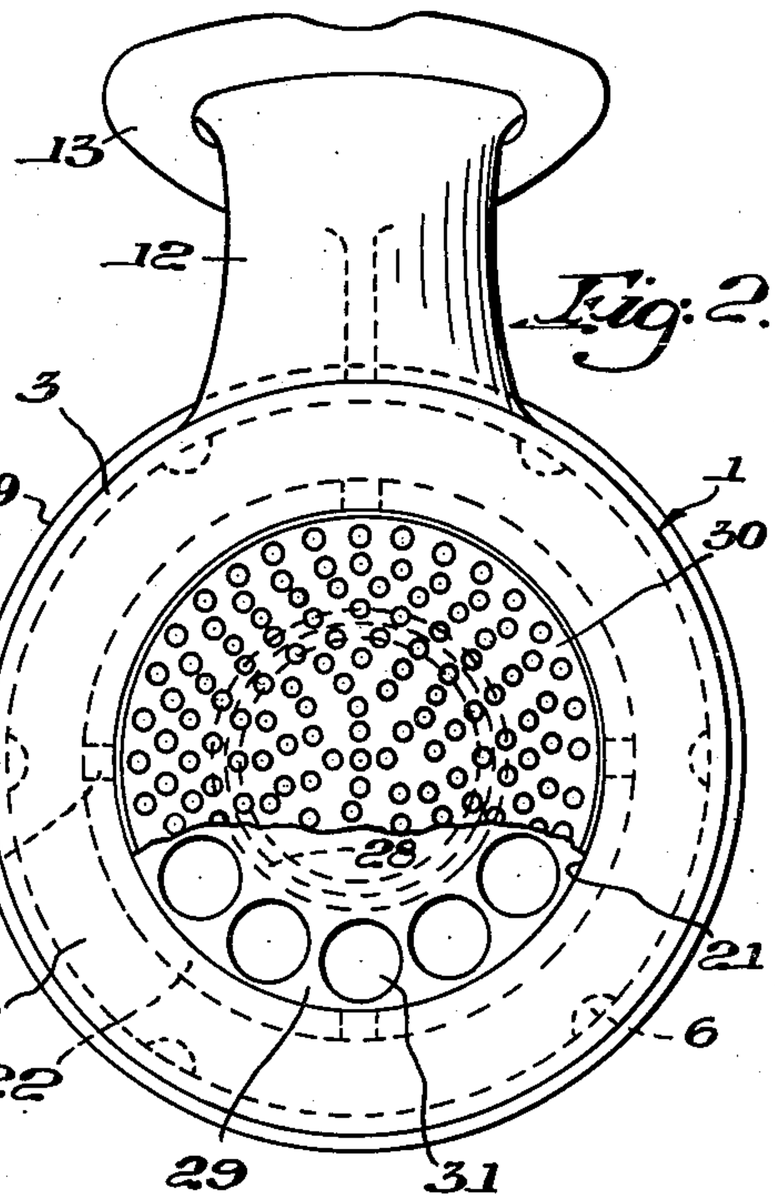

Fig. 2.

Fig. 3.

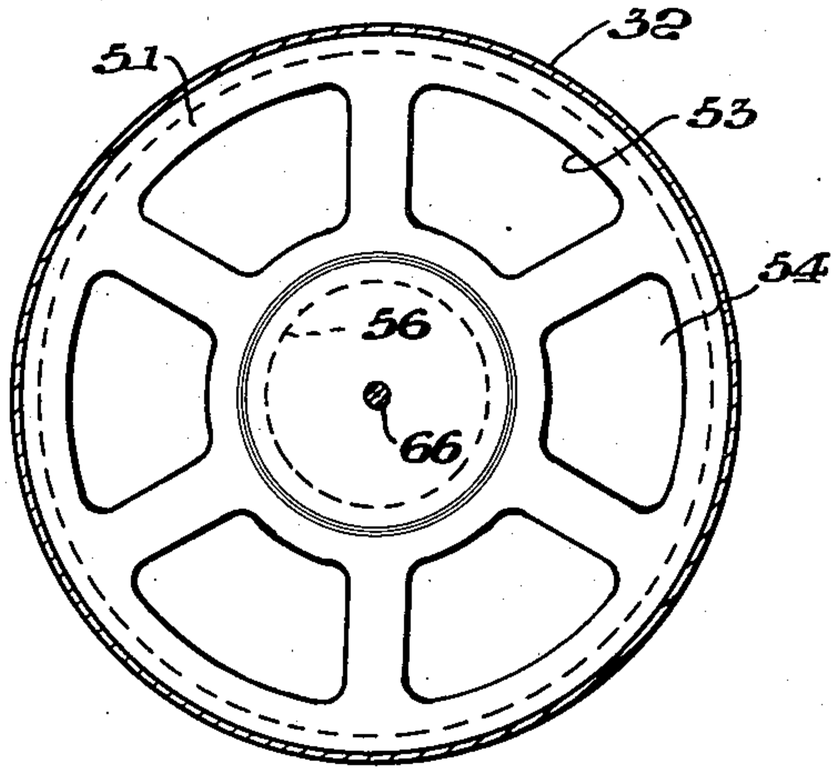

Fig. 6.

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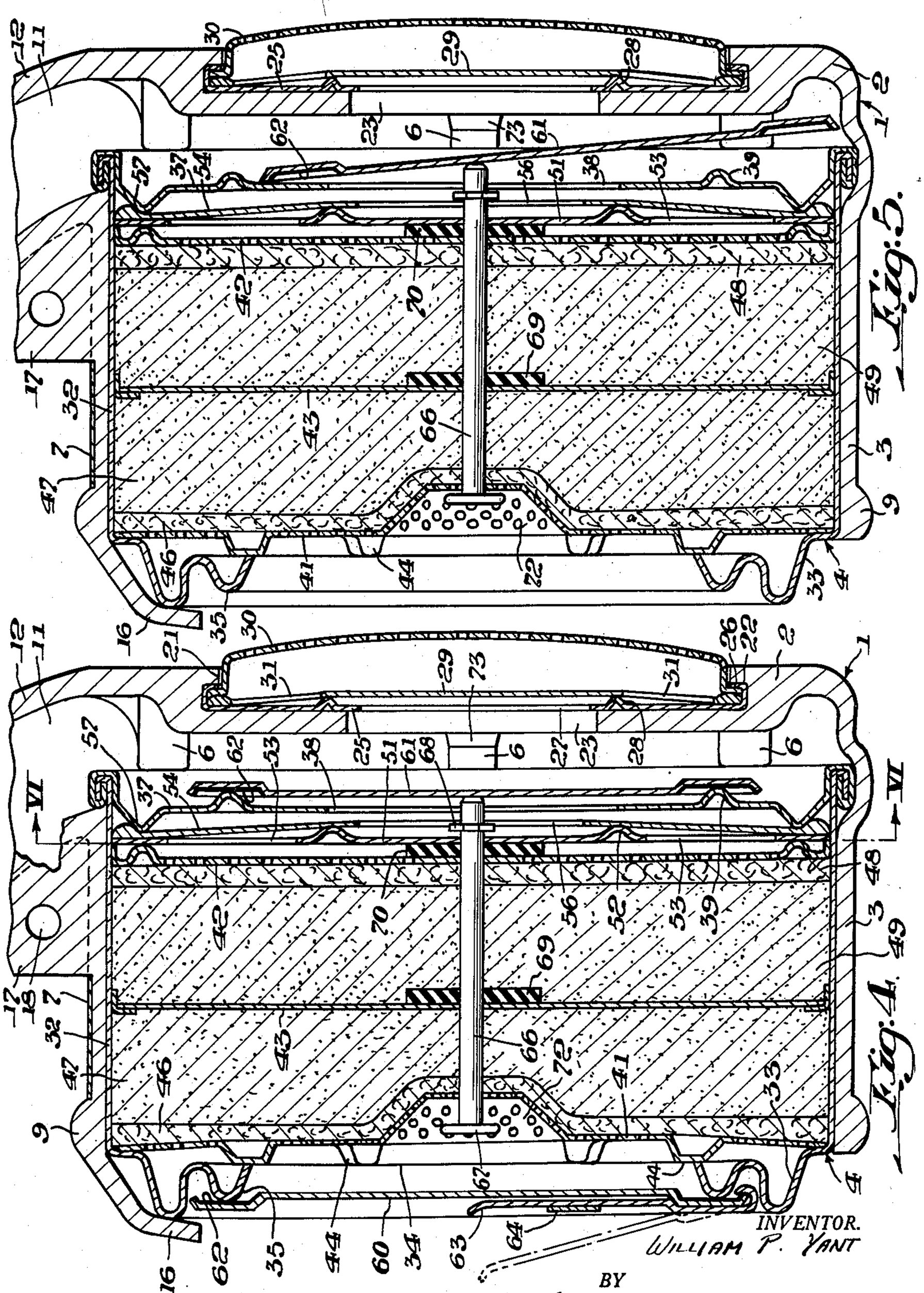

Fig. 3.

Fig. 4.

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SEALED AIR-PURIFYING CANISTER

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10 Claims. (Cl. 183—44)

1

This invention relates to air-purifying canisters, and more particularly to those mounted in respirators where the inner ends of the canisters are inaccessible.

The chemicals with which air-purifying canisters are filled deteriorate from exposure to air, even though the respirators are not being used. The life of the chemicals can be prolonged indefinitely if they are sealed in the canisters under vacuum, but unsealing or opening such canisters when they are mounted in respirators presents a problem, because their inner ends are completely enclosed within the bodies of the respirators and cannot be reached.

It is among the objects of this invention to provide an air-purifying canister in which the chemical is sealed, in which both the inlet and the outlet opening can be unsealed quickly by means manipulated from the inlet end of the canister, and which is compact and inexpensive.

In accordance with this invention the wall of the canister is formed by a can which has axially spaced inlet and outlet openings surrounded by seats. The seats are engaged by removable covers which close the inlet and outlet. An air-purifying unit is mounted in the can and contains a chemical whose life is prolonged by sealing the can, preferably under vacuum. Means is provided for prying the inlet cover off its seat at the outer end of the canister. When this has been done, a pin, which extends axially through the can and is slidably mounted in the air-purifying unit, is pushed inward far enough to push the outlet cover off its seat at the inner end of the canister. Thus, both inlet and outlet are opened from the outer end of the canister. Before removal, the covers preferably are held against their seats by adhesion as well as suction. An inhalation valve of improved construction may be mounted in the can between the air-purifying unit and outlet cover. Although this canister can be made for use with any suitable type of respirator, it is designed primarily for use in a small respirator which is intended to be carried by a person who is exposed to an atmosphere that may accidentally become noxious. Such a respirator is called a self-rescuer, and as it is used only in emergencies, it may be months or years before an emergency arises which calls for its use. For this reason it is highly desirable that the chemical in the canister be preserved indefinitely so that it will be ready for use at any time. This makes it important that the canister be sealed until it is to be used.

The preferred embodiment of the invention is

2

illustrated in the accompanying drawings, in which Fig. 1 is a rear view of the respirator showing the outer end of the canister; Fig. 2 is a front view of the respirator with part of the exhalation valve broken away; Fig. 3 is a side view; Fig. 4 is an enlarged central vertical section through the respirator while the canister is sealed; Fig. 5 is a similar section after the canister covers have been removed; and Fig. 6 is a reduced vertical section taken on the line VI—VI of Fig. 4 and showing the inhalation valve.

Referring to the drawings, the body of a small respirator is in the form of a cup 1 turned on its side so that it has an upright thick end wall 2 encircled by a substantially cylindrical side wall 3. This cup is made from impervious flexible material, such as rubber. Removably mounted in the cup is a cylindrical air-purifying canister 4 containing chemicals for drying and purifying any air that may be inhaled through it. The inner end of the canister must be spaced from the end wall of the cup to provide a chamber for the purified air as it leaves the canister. For this purpose the end wall of the cup is provided with a plurality of circumferentially spaced bosses 6 that limit the distance the canister can be inserted in the cup. To hold the canister in the cup and to prevent leakage of air between their adjoining side walls, the side wall 3 of the cup is encircled by a clamping band 7, the ends of which are drawn together by a removable screw 8 in a well-known manner. Movement of the band outwardly on the cup is prevented by an integral annular bead 9 which encircles the open end of the cup.

The space or chamber between the inner end of the canister and the end wall of the cup is provided with an air outlet or passage 11, preferably formed in the upper portion of the cup's side wall. Secured to the cup around this air passage and extending upwardly therefrom is a tubular member 12 which curves back over the cartridge. Joined to the upper end of this member is a mouth-piece in the form of a surrounding flexible flange 13, from the end portions of which project lugs 14 inclined upwardly. The lugs are intended to be gripped between the teeth of the wearer, with flange 13 inside the mouth between the teeth and lips. The lips surround the upper end of the tubular members so that the wearer can inhale through it to draw air through the canister, where it is purified, and then out of the cup through passage 11. The respirator is supported by the mouth-piece, with the upper part of the respirator body engaging the front of the

chin. To keep the lower lip and chin out of contact with the metal canister, and also to make the respirator more comfortable to use, the upper part of the cup has an integral flexible rubber pad 16 that extends rearwardly over the upper edge of the canister and down between it and the chin for a short distance.

Between the lower side of tubular member 12 and the cup there is a vertical web 17 provided with a hole 18, to which a nose clamp (not shown) can be tied. Such a clamp, of any well-known form, is used for clamping the nasal passages shut while the respirator is being used, so that the wearer cannot inhale through his nose at that time.

With certain chemicals in the canister, exhalation as well as inhalation can take place through it, but other chemicals must not be subjected to the exhaled breath. Therefore, the respirator preferably is provided with an exhalation valve. For this purpose end wall 2 of the cup is provided with a large central recess 21, the inner end of which is encircled by a groove 22. The inner end wall of the recess is provided with a central opening 23. Mounted in the recess is the exhalation valve. This valve has a circular back in the form of a shallow cup 25 provided with circumferentially spaced lugs 26. The central portion of this cup is provided with an opening 27 that is surrounded by a raised valve seat 28. Disposed against the seat is a flexible diaphragm 29, the beaded outer edge of which is clamped between cup 25 and a flange forming part of a perforated cup-like cover 30. The cover flange is pressed against the diaphragm by the lugs 26 which are bent over against the flange. The portion of the diaphragm between its beaded outer edge and the valve seat is provided with a plurality of circumferentially spaced holes 31, so that when exhalation takes place the exhaled air pushes the diaphragm off its seat and then flows radially past the seat and out through the diaphragm holes and the perforated cover. It will be seen that this valve is very thin and therefore projects only a short distance from the front of respirator cup 1.

The canister side wall 32 is formed from a cylindrical metal can which has an integral outer end wall 33 provided with a large central inlet opening 34. The end wall is provided with annular corrugations to strengthen it and to provide a seat 35 around the inlet. The can also includes an inner end wall 37 that is provided with a large central outlet opening 38 encircled by a raised seat 39. Disposed in the can between its end walls is an air-purifying unit. Although this unit may be made up in different ways, the one shown has axially spaced perforated end plates 41 and 42 and a perforated center plate 43. The outer plate 41 engages the marginal portion of the outer end wall of the can and may be provided with circumferentially spaced detents 44, to help space the inner edge of the adjacent wall from the plate so that substantially the full area of the plate will be exposed to air entering inlet opening 34. Engaging the inner face of the outer end plate is a layer 46 of pervious material that serves as a filter and also prevents an air-drying chemical 47, which fills the space between it and the center plate, from escaping through the perforations in the outer plate. A similar layer 48 of filtering material engages the inner face of the inner perforated plate 42 and prevents an air-purifying chemical 49, with which the space between the

filter and the center plate is filled, from escaping.

To prevent any exhaled air from passing back through the canister, it may be provided with an inhalation valve that closes during exhalation. This valve preferably includes a seating plate 51 that is spaced a short distance from the outer face of the inner perforated plate 42 and that has a solid central portion encircled by a raised seat 52. Between this seat and the outer edge of the plate there are circumferentially spaced openings 53. A flexible diaphragm 54 engages the valve seat and covers the openings in the seating plate, but the central portion of the diaphragm is provided with a large opening 56. The beaded outer edge of the diaphragm and the seating plate are clamped against the adjoining perforated wall of the air-purifying unit by an annular rib 57 pressed into the inner end wall of the can. During inhalation, air passes through the openings 53 in the seating plate and forces the diaphragm off the seat so that the air can flow radially past the seat and then through the central opening in the diaphragm. With this inhalation valve, in which the outer edge is clamped, there is no tendency for the outer edge to curl away from the seating plate. As the inner edge of the diaphragm is formed by a central opening, there likewise is no tendency for that edge to curl away from the seat.

Another feature of this invention is that the canister can be hermetically sealed by covers 60 and 61 applied to the seats 35 and 39, respectively, around the inlet and outlet openings in its end walls. Accordingly, each cover preferably has a layer of plastic sealing material 62 on its inner surface adjacent its outer edge. This material engages the adjoining seat and tends to stick to it. The covers are applied to their seats while the canister is under vacuum, so that atmospheric pressure will press the covers tightly against the seats to seal the canister. Although the canister is mounted in the cup-like body of the respirator, it is an easy matter to pry off the outer cover 60 with any suitable implement, but to assure the presence of such an implement at all times, a lever 63 may be attached to the cover. This lever extends radially outward from the center of the cover and has its outer end curved around the outer edge of the cover. The lever may be held flat against the cover by means of adhesive tape 64. When the tape is removed and the inner end of the lever is swung outward, the lever will fulcrum on the outer corrugation of the front wall 33 of the can and pry the cover off its seat.

The problem then is to remove the inner cover 61, which will remain stuck to its seat by sealing material 62 and which cannot be seen because it is concealed inside the rubber cup. This problem is solved in accordance with this invention by providing the air-purifying unit with an axial passage, preferably at its center, in which a pin 66 is slidably mounted. The solid center portion of inhalation valve seating plate 51 is provided with a hole in line with this passage so that the pin also can extend through it. The outer end of the pin is provided with a head 67, and a snap washer 68 may be applied to its inner end to prevent accidental removal of the pin, which would leave an unobstructed passage directly through the air-purifying unit. The layers of filtering material 46 and 48 at opposite ends of the unit frictionally engage the pin and form seals around it. Another seal may be provided by a flexible

washer 69 mounted on the pin adjacent the perforated center plate 43. A similar washer 70 may be mounted on the pin between the inner perforated plate 42 and the valve seating plate 51. This last washer also serves to space the adjoining plates apart.

The pin projects from the opposite ends of the air-purifying unit far enough to permit it to be pushed inward a distance sufficient to push the inner cover 61 off its seat. For this purpose the inner end of the pin may substantially engage the inner cover while the head of the pin is spaced from the outer perforated plate 41. To assure that the pin can be pushed inward far enough, even though its head is spaced a suitable distance from inlet cover 60, it is desirable to provide the central portion of the outer perforated plate with a depression 72 that will space the plate the desired distance from the head of the pin. When the pin is pushed inward to unseat the outlet cover 61, that cover will drop down into the space between the inner end wall of the can and end wall 2 of the cup. To prevent this loose cover from obstructing or closing the outlet opening 23 in the cup during exhalation, the inner surface of the cup end wall is provided on opposite sides of that opening with a pair of horizontally spaced bosses 73 which will space the cover from the opening.

It therefore will be seen that both covers can be removed from this hermetically sealed canister by simple operations quickly performed at the exposed outer end of the canister. That is, first the outer cover is removed by means of lever 63, and then the exposed head of the pin is pushed inward to remove the inner cover. It only takes a moment to perform these two operations in order to place the respirator in condition for immediate use, with assurance that the chemicals in the canister will be fresh and capable of performing their intended functions.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A sealed air-purifying canister for use in the cup-like body of a respirator where the inner end of the canister will be inaccessible, the canister comprising a can having axially spaced inlet and outlet openings surrounded by seats, an air-purifying unit mounted in the can, covers engaging said seats to close said openings, means for prying the inlet cover off its seat at the outer end of the canister, and a pin extending axially through the can and slidably mounted in said unit, the pin projecting from the outer end of said unit far enough to permit it to be pushed inward to push the outlet cover off its seat after the inlet cover has been removed, whereby both of said openings can be opened from the outer end of the canister.

2. A sealed air-purifying canister for use in the cup-like body of a respirator where the inner end of the canister will be inaccessible, the canister comprising a can having axially spaced inlet and outlet openings surrounded by seats, an air-purifying unit mounted in the can, covers engaging said seats to close said openings, means for prying the inlet cover off its seat at the outer end of the canister, and a pin extending axially through the can and slidably mounted in said unit, the outer end of the unit being provided with a depression surrounding the pin, the inner end of the depression beng spaced far enough from the projecting outer end of the pin to permit the pin to be pushed inward to push the outlet cover off its seat after the inlet cover has been removed, whereby both of said openings can be opened from the outer end of the canister.

3. A sealed air-purifying canister for use in the cup-like body of a respirator where the inner end of the canister will be inaccessible, the canister comprising a can having axially spaced inlet and outlet openings surrounded by seats, an air-purifying unit mounted in the can, covers engaging said seats to close said openings, a lever engaging the edge of the inlet cover and adapted to be swung outward to pry the cover off its seat at the outer end of the canister, and a pin extending axially through the can and slidably mounted in said unit, the pin projecting from the outer end of said unit far enough to permit it to be pushed inward to push the outlet cover off its seat after the inlet cover has been removed, whereby both of said openings can be opened from the outer end of the canister.

4. A sealed air-purifying canister for use in the cup-like body of a respirator where the inner end of the canister will be inaccessible, the canister comprising a can having axially spaced inlet and outlet openings surrounded by seats, an air-purifying unit mounted in the can, covers closing said openings and adhering to said seats, means adjoining the inlet cover for prying it off its seat at the outer end of the canister, and a pin slidably mounted in said unit and projecting from both ends of it far enough to permit it to be pushed inward to push the outlet cover off its seat after the inlet cover has been removed, whereby both of said openings can be opened from the outer end of the canister.

5. A sealed air-purifying canister for use in the cup-like body of a respirator where the inner end of the canister will be inaccessible, the canister comprising a can having axially spaced inlet and outlet openings surrounded by seats, an air-purifying unit mounted in the can and having perforated end plates provided with aligned holes, covers engaging said seats to close said openings, means adjoining the inlet cover for prying it off its seat at the outer end of the canister, and a pin extending axially through said unit and slidably mounted in said holes, the pin projecting far enough from said perforated plates to permit it to be pushed inward to push the outlet cover off its seat after the inlet cover has been removed, whereby both of said openings can be opened from the outer end of the canister.

6. A sealed air-purifying canister for use in the cup-like body of a respirator where the inner end of the canister will be inaccessible, the canister comprising a can having outer and inner end walls, the outer end wall being provided with a central inlet opening and the inner end wall being provided with a central outlet opening, perforated plates in the can adjacent to said end walls with at least their major portions spaced therefrom, said plates being provided with a pair of aligned central holes, a pin slidably mounted in said holes and projecting therefrom, air-purifying material disposed in the can between the perforated plates, covers closing said end wall openings and adhering to the outer surfaces of the end walls, and means adjoining the inlet cover for prying it away from the outer end wall,

said pin projecting from said plates far enough to permit it to be pushed inward to push the outlet cover away from the inner end wall after the inlet cover has been removed, whereby both of said openings can be opened from the outer end of the canister.

7. A sealed air-purifying canister for use in the cup-like body of a respirator where the inner end of the canister will be inaccessible, the canister comprising a can having axially spaced inlet and outlet openings surrounded by seats, an air-purifying unit mounted in the can, an inhalation valve mounted in the can between said unit and outlet opening, covers engaging said seats to close said openings, means adjoining the inlet cover for prying it off its seat at the outer end of the canister, and a pin extending axially through the can and slidably mounted in said unit and inhalation valve, the pin projecting from the outer end of said unit far enough to permit it to be pushed inward to push the outlet cover off its seat after the inlet cover has been removed, whereby both of said openings can be opened from the outer end of the canister.

8. A sealed air-purifying canister for use in the cup-like body of a respirator where the inner end of the canister will be inaccessible, the canister comprising a can having axially spaced inlet and outlet openings surrounded by seats, an air-purifying unit mounted in the can and having a perforated plate at its inner end spaced from said outlet opening, an inhalation valve seat member between said plate and outlet opening, a flexible inhalation valve diaphragm between said seat member and outlet opening, covers engaging said can seats to close said openings, means adjoining the inlet cover for prying it off its seat at the outer end of the canister, and a pin extending axially through the can and slidably mounted in said unit, the pin projecting from the outer end of said unit far enough to permit it to be pushed inward to push the outlet cover off its seat after the inlet cover has been removed, whereby both of said openings can be opened from the outer end of the canister.

9. A sealed air-purifying canister for use in the cup-like body of a respirator where the inner end of the canister will be inaccessible, the canister comprising a can having outer and inner end walls, the outer end wall being provided with a central inlet opening and the inner end wall being provided with a central outlet opening, an air-purifying unit mounted in the can and having a perforated plate at its inner end spaced from the inner end wall of the can and provided with a central hole, an inhalation valve seat plate

between said perforated plate and inner end wall, said valve plate having a solid central portion provided with a central hole and surrounded by a valve seat on its outer surface, the portion of the valve plate around its seat being provided with openings, a flexible diaphragm covering the openings in the valve plate and normally engaging its seat, the major portion of the diaphragm being spaced from said inner end wall and the central portion of the diaphragm having an opening through it, said inner end wall clamping the marginal portions of the valve plate and diaphragm against said perforated plate, a pin slidably mounted in said unit and central holes and projecting from the outer end of the unit, covers closing said end wall openings and adhering to the outer surfaces of the end walls, and means adjoining the inlet cover for prying it away from the outer end wall, said pin projecting from the valve plate and the outer end of said unit far enough to permit it to be pushed inward to push the outlet cover away from the inner end wall after the inlet cover has been removed, whereby both of said openings can be opened from the outer end of the canister.

10. A sealed air purifying canister comprising a can having inner and outer end walls, the outer wall being provided with an air inlet and the inner wall being provided with an air outlet, air purifying material in the can, perforated walls inside the can retaining said material in place, covers closing said inlet and outlet and adhering to the adjoining end walls, means outside of the can associated with the inlet cover for removing it, and a pin inside the can extending axially through it and slidably mounted in said perforated walls and projecting outward from both of them, said pin being adapted to be pushed lengthwise after the inlet cover has been removed, whereby to push the outlet cover away from the adjoining end wall to open said outlet.

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